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The Condition of the New York Canal Improvements.

It will be no news to most readers of this journal to be told that some delay seems probable in beginning the construction of the enlarged New York canals. Judging from newspaper comment, however, there is unwarranted surprise at the obstacles which are now thrown in the way of the enterprise. These obstacles are two-fold and are those which it is only reasonable to expect to encounter in the prosecution of such an undertaking. One relates to the constitutionality of the act under which the work will be done, and the other is uncertainty as to the legality of the forms of contract which have been used in securing bids for the first sections of the work. As the latter are less likely to cause marked delay it is hardly necessary to discuss them further than to point out the fact that they relate to legal questions and would not have arisen had the advice of the engineers connected with the work been followed.

The constitutionality of the act under which the improvements will be conducted has not been established. In many public works this is done at the outset of the work by a friendly suit, in order to set at rest any doubts on the subject. The probability is that the act is constitutional and will be so found by the courts. The difficulty lies in securing an early decision on the subject from the court of final jurisdiction. In discussing this aspect of the matter it has been said this week that the opposition to the canal came from a very few farmers and from certain railroad companies, which have not been named, who were endeavoring to oppose "the will of the people" for their own selfish advantage. As a matter of fact, the vote on the canal was not sufficiently large to be called an expression of the will of the people. If three men in a crowded car discuss the advisability of opening a window and two of them decide it should be done, this decision of two to one can hardly be called an expression of opinion of the majority of the passengers. The mere fact that a large number of the voters in the State did not care enough about the canal improvements to vote one way or another when the question of undertaking them was presented, would indicate that the will of the people has not been expressed one way or the other in any decided manner.

It is important to bear in mind that if a majority of the people of the State wish to improve the canals the work will surely be done. They may not have been enthusiastic on the proposition at the last vote, but if they have grown more favorably impressed with it, no legal struggle will thwart them. This has been the case with every great improvement which has encountered such obstacles, and was very well shown in the case of the New York Rapid Transit Railway work. It may happen, however, that the legislative acts for carrying on the work will prove defective, and for this reason it is manifestly much better to have them tested in the courts before than after great expenditures for work have been made. At the present time, it is difficult to see why there should be any serious flaw in the constitutionality of the act or why the courts cannot decide it quickly and speedily, since it involves great public interests. It will be recalled that this decision was reached very quickly in the early history of the Chicago Sanitary District.

Recent Advances in Water Filter Design in America.

Although the so-called rapid mechanical filter is a distinctively American device, the first slow sand filters in this country were based upon European practice, as the name, English filters, sometimes applied to them, well testifies. The progress in the design of mechanical filters for municipal water supplies, from the day of the tub with revolving rakes to this year of enlightenment, is shown to be very great when the older type is compared with some of the recent installations described in this journal. The cylindrical wooden tank type is still found satisfactory for the smaller plants in many cases, but the application of the "mechanical" method to the treatment of large quantities of water demanded a radically different form of construction. For the cylindrical wooden tanks have been substituted rectangular tanks of armored concrete; instead of revolving rakes, air under pressure is used to agitate the sand during the washing, and several new forms of strainers have been devised. Improved controllers, also, have greatly reduced the head required for operation. The plant at Little Falls, N. J., completed so recently as 1902, was the first and is still the most notable installation in service built on the new lines, and at Watertown, N. Y., is another mechanical filter plant illustrating some of the statements just made.

The advance in the structural features and operating details of slow sand filters, from the imported forms, is well shown by the description published last week of the small plant for the Hudson River State Hospital, at Poughkeepsie, N. Y.; the innovations here first embodied in actual construction are now being incorporated into the designs of some larger municipal plants. If in actual service these improvements fulfill the expectations reasonably entertained, they will, doubtless, be widely adopted.

Filter design has not yet reached the state that "leaves nothing to be desired," but during the past few years the leading American specialists certainly have been making rapid strides toward the perfected design. New plants have successively marked the solution of recognized problems and the attainment of greater economy and convenience in construction and operation. A rereading of the articles in this journal describing the Philadelphia, Ithaca, New Haven and other recently built plants will make apparent the progress which has been made since the earlier installations were put in. The Hackensack plant contains decided innovations in the design of mechanical filters, and the small plant for the Hudson River State Hospital shows some of the latest forward steps in slow sand filters. Indeed, it would appear that a distinctively American type of slow sand filters is now emerging.

In the earlier American and European slow sand filter plants much space was taken up by sand courts, and large volumes of water and the services of many men were required to wash and replace the dirty sand removed in the scraping of the beds. In the Poughkeepsie plant the sand court is placed on the roof of the covered filters, the sand is transported from the beds to the court by a portable ejector which uses only about half as many volumes of water to one of sand as certain older ejectors, and the sand washers of an improved and economical type are elevated sufficiently above the sand court to cause the washed sand to flow to the remotest parts of the court, with possibly a very little encouragement from a jet of water. Whenever a filter is to be resanded, washed sand will simply be dumped through the trap doors from the court overhead, and spread. These changes have made possible still another—the elimination of the sand run and its imposing entrance, which has been hitherto so familiar and conspicuous a feature in filter landscapes. Now that Mr. Hazen has put the sand court on top of the filters, it seems like such an obvious thing to do that one wonders why it was not done before.

In considering the pros and cons of covered, as compared with open filters, the reduction in the cost of land and construction, together with the increased economy and convenience in operation, secured by placing the sand courts on top of the filters may make it possible to cover the filters and obtain the resulting advantages in some cases in which strict economy in first cost would otherwise lead to the selection of open filters. At New Haven, it will be remembered, a similar economy of land is effected by a different expedient; the sand courts are omitted altogether and the sand runs likewise, the works being so proportioned that one bed can always be out of commission and in a condition to receive washed sand. Here the sand is to be washed at once as scraped from the various beds in service and discharged directly onto the receiving bed by means of a portable ejector, a portable washer and a specially devised receptacle. In this plant, furthermore, the beds are arranged on opposite sides of a covered court, so that practically all the work connected with the operation of the filters is carried on under roof. No storage for dirty sand is required, and even the regulator houses are dispensed with, an operating gallery being substituted closely resembling the corresponding member of a mechanical filter plant. An innovation is found in the covering also, which is of armored concrete slab-and-beam construction, instead of the familiar groined arches.

In the plant now under construction at Washington, D. C., the beds are grouped into units or batteries for purposes of control, several beds being served by each regulator house. This not only reduces the number of regulator houses very materially, but also makes a gain in convenience of operation. This idea was embodied also in the designs for a slow sand filter plant at Pittsburg. In the design for the Stormville filters, a part of a system of water-works proposed for providing an additional supply of water for New York City and described in the Burr-Hering-Freeman report, the plant, intended to have an ultimate capacity of 500,000,000 gal. per day, is divided into units of twenty filters each, with a long operating gallery, the New Haven idea being adopted. There is an operating station at the center of each unit. from which all operations will be controlled. Raw water is brought from impounding reservoirs through two large aqueducts, interconnected and regulated at the upper end of the plant by a switch gatehouse, and a compensating basin with a regulating gatehouse facilitates the holding of the raw water at a practically constant level on the filters. The water taken into the effluent drain system is ordinarily to be pumped to a reservoir adjacent to the filters and used under gravity pressure for washing and transporting sand and for operating the hydraulic valves. No overflows are provided in the filters, the regulating gatehouse mentioned above being depended upon for the control of the raw water level. In each operating station there are two large mine ventilating fans to deliver large volumes of air into the adjacent pipe galleries so that whenever any filter in the unit is opened for cleaning, this air will pass through the open filter, removing the dampness.

Some of the old distinctions between mechanical and slow sand filters are thus seen to be passing. With the greater compactness of arrangement of the slow sand filtration plant and the attendant reduction of first cost, and the improvements in mechanical filters leading to economy and security of operation, the choice of the one or the other for a given place is coming to depend more completely on suitability to local requirements and less on cost. Not only in the larger plants is improvement to be recorded. In smaller mechanical installations the wooden cylindrical vat has in some cases been superseded by metal or masonry tanks, as at Trieste, Austria, and Danville Ill., and improved strainers and agitators have been devised, and, as in the larger plants, air has sometimes been substituted for the rakes. In the plant for Cornell University, at Ithaca, N. Y., concrete-steel tanks of a decidedly unique form were built; as these cannot be characterized by a word or two, the reader is referred to the illustrated description printed April 9, 1904.

The New York Water Supply Commission and the Am. Soc. C. E.

This journal has occasionally expressed the hope that in some way the representative character of the American Society of Civil Engineers might be shown by its co-operation in an advisory manner with some of the great public engineering undertakings. The Society has lately received several marked honors, but none more significant of its standing in the community than one conveyed by the Mayor of New York. His proposition is one which demands careful consideration from several standpoints. This journal has accordingly requested the chief engineer of the Manhattan Railway Co. to state in this place his views on the subject as it appears to a director of the Society and an engineer of long experience in executive positions of the highest responsibility.

The American Society of Civil Engineers has received in the past year three notable compliments; the visit of the Institution of Civil Engineers of Great Britain, the assignment of the conduct of the International Congress of Engineers at the St. Louis Exposition, and lately, Mayor McClellan's proposal to have one of the three commissioners for the water supply of the city of New York appointed from three names to be submitted by its governing body. Mayor McClellan's compliment is heightened by his evident desire to place the selection of the commission on the high plane of the best interest of the public, freed from commercial or political bias, in proposing that one other commissioner shall be appointed from three names to be submitted by the Chamber of Commerce.

The three compliments named are unprecedented and mark the growing national prestige of the American Society of Civil Engineers. The acceptance of the last, however, involves a question of Society policy which will doubtless be widely discussed. It would be natural for the public to assume that the Society would thus gladly serve it, but the compliment was probably invited by the known conservatism of the Society which has given it the high place it now holds in public esteem, and that conservatism may lead to unexpected action.

Without presuming to say what position the Society should take, the writer would submit a few considerations that occur to him on both sides of the question as to whether the Society should make the nominations proposed. The policy of the Society has been to avoid recommending any individual for any position. If it were asked to name an engineer to carry out the work of the commission it would doubtless decline at once. The reason for this is obvious. It cannot distinguish in a business way among its members. It exists for the advancement of engineering untainted by commercial considerations. The best scientific fruits of the work of its members are given to the world freely, often at great cost and sacrifice on the part of its members. The Society, however, receives certain considerations from the public, freedom from taxation, for instance, and where the public welfare demands some action on its part it may be not only the part of patriotism but of self-interest to take it. Can the worthy object which Mayor McClellan aims at be so well accomplished without the Society's assistance? Does not the enhancement of the Society's prestige demand acquiescence? It may be said that this is a local affair, while the Society is national. True, but its exemption from taxation is a local affair, and further, the same distinction has not been accorded to it in a national affair.

It may be that as the policy of the government may change as a world power, so the policy of the Society may change with extended influence, and enable the profession to receive that recognition from the public which its members often feel is not sufficiently accorded to it now.

The "governing body," or Board of Direction, is representative of the whole Society. It is constantly changing, so that it shall always be representative. If it assumes to select three men from whom a commissioner shall be chosen, does it make any greater distinction among the members of the Society than has been made in grading the members or in electing the Board? Such occasions will not be sufficiently numerous to affect the business interests of individual members to any great extent, and if they were, should not the general interests of the profession have first consideration? In naming three men from whom a commissioner shall be appointed the Society accepts a great responsibility. Known experts in certain lines of engineering work may not have those qualities of generalization, of ability to work harmoniously with non-experts on the same commission, and sufficient breadth to assign parts of the work to others without unduly hampering them in its execution. While a good appointment would do the Society credit, a bad one would bring disproportionate discredit. It hardly seems likely, however, that the governing body of the Society could make a mistake of this kind. Geo H. Pegram.

Some General Features of Iron and Steel Structural Design.

Experience with the construction and maintenance of iron and steel bridge structures has shown that their average life may reasonably be placed at not more than twenty years. For a material which has in it the elements of indefinite duration when properly cared for, this is a condition of things which would be considered remarkable had it not already become a matter of almost every-day observation. It was certainly supposed fifty years ago that the life of iron structures would be practically of indefinite length in comparison with those built of such perishable material as timber. At the present time it is a fact that there are timber structures in existence which have stood up to their duty as long as most iron bridge structures of record. Although this condition of things has ceased to be a matter of much remark, it is worthy of serious consideration. There is certainly something wrong where a material that with ordinary care may have indefinite length of life, without deterioration in quality, is adapted to structural work in such a way as to outlast only to a small extent structures of such a perishable material as timber.

This condition indicates unsatisfactory treatment in designing, which must inevitably result in ultimate extravagance and wastefulness. The enormous development of railroad properties in this country and the rapid increase of wealth of communities where iron bridges have been built have been such that the wastefulness of these procedures has been felt but little and noticed less. The returns from those business and municipal interests which have been affected by or really dependent upon the transportation made possible by bridge structures have been so great that it has seemed of little consequence whether an iron bridge was renewed on the average in fifteen or twenty years or not, but the principles of sound economy and good engineering have, nevertheless, been just as much violated. This replacement of the lighter by a heavier iron bridge has been going on so long that it has practically been accepted as a necessary and legitimate procedure in bridge construction or in the administration of interests dependent upon such structures.

The design and construction of masonry structures is far different and always has been. This is natural enough, but it ought to be a sufficient ground for serious reflection whether the design and construction of steel bridges is yet on a proper basis. In the early days of bridge building it was necessary, as a rule, to secure bridges at the least possible cost, and that was a sufficient justification for the building of light iron structures in preference to the costlier, although far more durable, masonry bridge. These considerations, in the main, are now matters of the past, and the conditions which at first compelled the adoption of a comparatively low-priced structure no longer control, at least in many cases. It is by no means clear that low first cost even in the early days of railroads and municipalities was ultimate economy; indeed, in many cases it can be shown that it was wasteful and that a more costly structure of more durable character would have been ultimate economy. However that may have been, it is time now to give the whole matter the attention which its importance requires.

It is generally accepted at the outset that a masonry structure as usually designed has a practically indefinite duration of life and requires little care in its maintenance, but that is by no means the case. In most parts of the United States there are few masses of masonry that do not require, from time to time, some attention in maintenance, and occasionally much attention is necessary. Indeed, if a masonry structure were designed with no greater margin of safety than that which characterizes iron and steel bridge design, it is certain that the reputation of such structures for withstanding the attacks of time and the weather would soon suffer. The secret of the long life of masonry is based upon two features of construction, first, a large factor of safety, two to four times that of a corresponding steel structure, and the excellence of the material employed, assuming for both classes an equal excellence in workmanship. If either of these elements of carrying capacity are trenched upon, the life of the masonry structure may be correspondingly lessened. In other words, with the present excellence of material and workmanship usually available, the durability of the masonry bridge is chiefly due to the comparatively greater margin of safety employed. The iron or steel structure, on the other hand, from its earliest days, has been figured down in the sectional area of its members to the least possible limit permissible under specifications drawn to secure the lowest-priced bridge.

As a matter of fact, it is perfectly well known that even the nominal factor of safety for iron or steel bridges is seldom realized in a completed structure. The whole tendency has been to reduce the mass of steel to the least permissible amount, whereas in masonry the opposite tendency has prevailed. These observations do not hold to quite the same extent in such modern masonry structures as those of reinforced concrete, although they are more or less applicable even in connection with such structures. It becomes a serious question whether the design of steel bridges and other structures should not be treated with the same liberality in the safety factor as the best masonry structures of the date. If the nominal safety factor of an iron railroad bridge thirty years ago had been seven or eight instead of four or five, there would have been no reason for displacing such structures if properly designed and built even at the present time, at least to any great extent, and it certainly would have been economy in the long run to have followed that procedure. A well-painted and properly-cared-for iron or steel structure has even a greater capacity for durability than most first-class masonry structures as they now exist. The metal under such conditions is absolutely unaffected by any atmospheric influences whatever, and there is no reason to believe that any chemical or other similar deterioration ever takes place. In the administration of the great interests, whether corporate or municipal, where ultimate economy in bridge construction is just as important as any other questions of economy, these matters ought to receive most careful attention. There is no sufficient reason whatever why iron or steel structures should not have a sufficient margin of safety to give them an indefinitely long life, and in many, if not most, cases it would be wise economy to do so.

The Adjusted Losses of the Baltimore Fire.

The Baltimore Committee of the National Board of Fire Underwriters has just published its report on the adjusted fire losses on the buildings of fireproof construction which were damaged in that city. It is hardly necessary to say that this is a most important document, for it makes public the extent of damage done to these buildings, as determined by the organization which has most influence in such matters. There are twenty-three buildings on which data concerning the sound value, fire damage and insurance losses are tabulated. Their total valuation was $6,546,040, on which the fire damage amounted to $3,684,062. The insurance amounted to $3,606,622, and the losses paid were $2,752,889. All possible information on losses was obtained concerning buildings of all heights and types of construction which to any considerable degree could be regarded as fireproof, either on account of their construction or their fire loss. It is noticeable that the building of poorest construction, as a whole, showed the smallest ratio of fire damage to value of any of the four-story or higher buildings considered. This was the four-story structure of the Commercial and Farmers' National Bank, the third and fourth floors and roof of which were of ordinary floor boards on wooden joists. The lower floors were of concrete arches and steel beams. The explanation of this small loss is that the building was well shielded and the wood construction, which was totally destroyed, represented but a small part of the total value.

The committee makes the deduction from its studies that when a city is visited by a general conflagration, the large, high, so-called fireproof buildings, without protection at the exterior windows and exposed by ordinary buildings, are but little better from an insurance viewpoint, than any other class of property. None of the steel frames of the largest buildings twisted to any great extent, but, the committee states, there were enough instances where the steel frames were sufficiently distorted to show the possibility of serious collapse during such a conflagration. The committee points out that the question of fireproofing is a most serious one, as the fire developed a great deal of shoddy work. Some of the so-called fireproofing was found to be practically useless, indicating that architects and insurance people may have been too lenient in passing inferior materials and poor workmanship.

The Improvement of Cardenas Harbor in Cuba has been practically completed, and the contractor, Col. M. J. Dady, is arranging to return his equipment to the United States. This work is one of the most interesting undertaken on the Island. It involved the cutting of a channel 15,000 ft. long and 150 ft. wide under difficult conditions. All the water used on the dredges, about 2,000 gal. daily, had to be carried 12 miles from Cardenas. At times the rough weather made it necessary to suspend operations for many days, as the dredges worked practically in an open seaway. The channel is 150 ft. wide and the excavation amounted to 80,000 cu. m. of rock and 100,000 cu. m. of sand. It was originally proposed to make the canal 300 ft. wide, but at the suggestion of Col. W. M. Black half that width was finally adopted.

The Rapid Estimation of Combustion, as shown by the chimney gases, was the subject of a recent paper by Mr. H. le Chatelier, printed in "Revue de Metallurgie." The method is based on the variation in the conductivity of a porous connection held between two platinum conducting wires, the connecting piece being impregnated with copper in a fine state of subdivision. It appears that when the chimney gases contain an excess of oxygen the copper becomes oxidized and the conductivity of this connecting piece is lowered, while a reverse effect upon the conductivity is noticed when the gases contain little free oxygen and much carbonic oxide. The reducing action of the waste gases in the latter case restores the copper oxide to the metallic state and increases the conductivity. It is stated that a temperature of 750° to 930° Fahr. is most suitable for use of this apparatus. A Leclanche cell is used as the source of current and a galvanometer for reading the variations in resistance.

State Road Work in Iowa is being carried on in a unique manner. The legislature appointed the Iowa State College the State Highway Commission, and the authorities of the college placed the work under the charge of Deans Marston and Curtiss, of the Divisions of Engineering and Agriculture, respectively. Mr. T. H. MacDonald was placed in immediate charge. Since last July, when funds for the work first became available, the Commission has made a personal study of the methods of road construction in various eastern states where public assistance in such work is provided. A general study has also been made of the road problem of Iowa, and road maps of each county have been commenced. Standard plans are being prepared; the studies for reinforced concrete culverts are being carried on not only for the state road work but also as a part of the investigations being made by the joint committee on concrete and concrete-steel of the leading engineering societies. An important feature of the work undertaken is the collection of detailed data in different parts of the state regarding the exact amount of travel over the country roads and its cost. Records are also being kept of the prices of farm produce in different parts of the state, together with records of the conditions of the roads. The Commission has just succeeded in having included in the questions to be answered during this year's state census a number of questions concerning roads. When the cards are returned by the census officers more complete information will have been secured on the subject of travel on country roads in Iowa than has ever before been collected anywhere. It is evident, therefore, that the programme which the college has laid out in its capacity as State Road Commission is a most ambitious one, and if funds are provided for the work it is probable that its achievements will prove of the highest value. The best feature of the whole undertaking is the high tribute paid to the efficiency and knowledge of the college faculty by the legislature in turning the work over to them.

The Chapel of the U. S. Naval Academy, Annapolis.

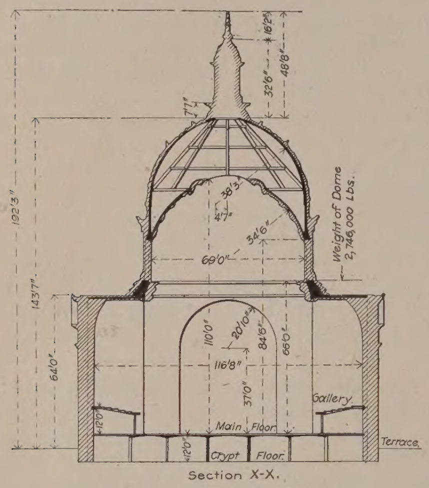
One of the most interesting buildings now under construction in this country is the chapel of the United States Naval Academy at Annapolis. It was designed by Mr. Ernest Flagg, of New York, architect of the new Academy, and was originally planned as a solid concrete structure with an outside facing of granite and white brick on the walls and terra cotta on the dome. This massive construction was decided to be unnecessarily heavy and expensive, and accordingly suggestions for a lighter building, following the architect's lines, were considered. The plans of the Noel Construction Co. and the Baltimore Ferro-Concrete Co. were accepted, and the work has been carried out in accordance with them by the latter company. The main feature of this design was to construct the dome and the four arches over the galleries of reinforced concrete, and to carry their total load directly down to the foundations by means of reinforced concrete pillars, thus enabling the walls to be greatly lightened. The eight columns supporting the dome are each 6x2½ ft. while the eight columns for the arches are 2x1 ft. All these columns will be concealed in the walls, leaving no concrete visible outside.

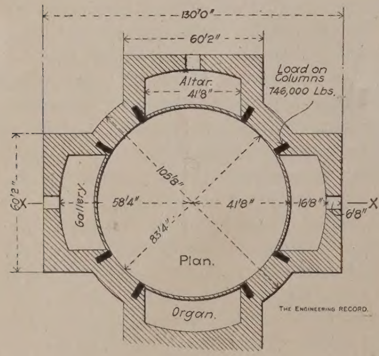
In its general plan the building is something like a Greek cross. The main floor is a circle 83 ft. 4 in. in diameter, with transepts increasing the clear width on the main axes of the building to 116 ft. 8 in. The outside diameter is 130 ft. The main building is 64 ft. high and is crowned by a double dome supporting a lantern rising to a total height of 192 ft. 3 in. above the ground. The general appearance of the building and its leading dimensions are shown in the illustrations on this page. The exterior wall of the building will be 18 in. thick, then comes an air space of 12 in., and finally the inside wall, 12 in. thick. Caen stone will be used on the inside walls and terra cotta will be used in covering the concrete columns supporting the dome, as well as the dome itself. The proportions of the concrete used in the reinforced-concrete structure were one part Lehigh Portland cement, three parts sand and five parts gravel.

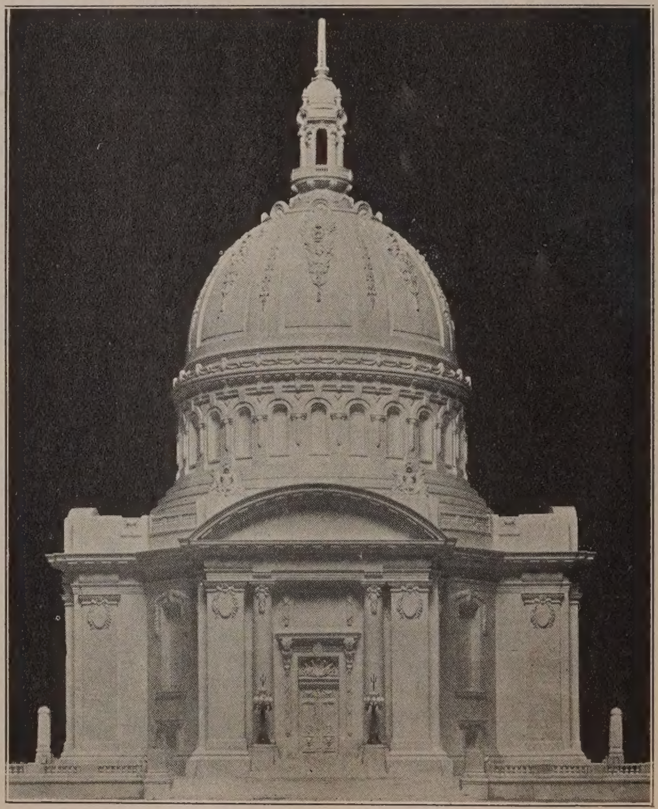
The details of the reinforced concrete portions of the structure are so well shown in the drawings that it is unnecessary to explain them. The difficulty that the engineers of the Baltimore Ferro-Concrete Co. met in planning the structure was due to the relative diameters of the main floor and the dome; the dome is but 70 ft. in diameter, while the main floor is 83 ft., and the weight of the dome must accordingly be carried by cantilevers on the columns. These columns are accordingly given a curved bracket shape, beginning at an elevation of 55 ft., and at their top, at an elevation of 76 ft., are bound together by a deep ring of reinforced concrete. This ring is wholly independent of the lateral arches, and its weight over them is transferred to the columns by inclined struts of reinforced concrete.

The ring supports twenty-four columns, carrying a small ring from which the main dome springs. The terra cotta lantern which crowns the building is an important feature of the design. It weighs about 120 tons, and this weight and the wind pressure on it could not be carried safely by the shell of the dome. Accordingly a reinforced concrete framework of pyramidal form has been built inside the dome and the load due to the lantern is transferred by it directly to the lower vertical walls.

The work has been done under the direction of a corps of French specialists in concrete-steel construction. No permanent falsework has been employed except a light tower outside the building, which is used for hoisting the materials, and is shown in one of the illustrations. The forms were kept on the concrete only long enough for the latter to harden, and were then raised and clamped in position for a new batch of material. As a rule the forms were raised about 2 ft. at a time. The construction of the domes in this way was most interesting. The molds for the outside face were first put in place, and then those for the inner face were hung from them. The reinforcement and concrete were filled in between the boards and the concrete allowed to harden for a few days. The molds were then pushed forward and upward to conform with the desired curvature of the dome, until, when the work had reached the vicinity of the crown, the men were working on a practically unsupported floor of reinforced concrete.







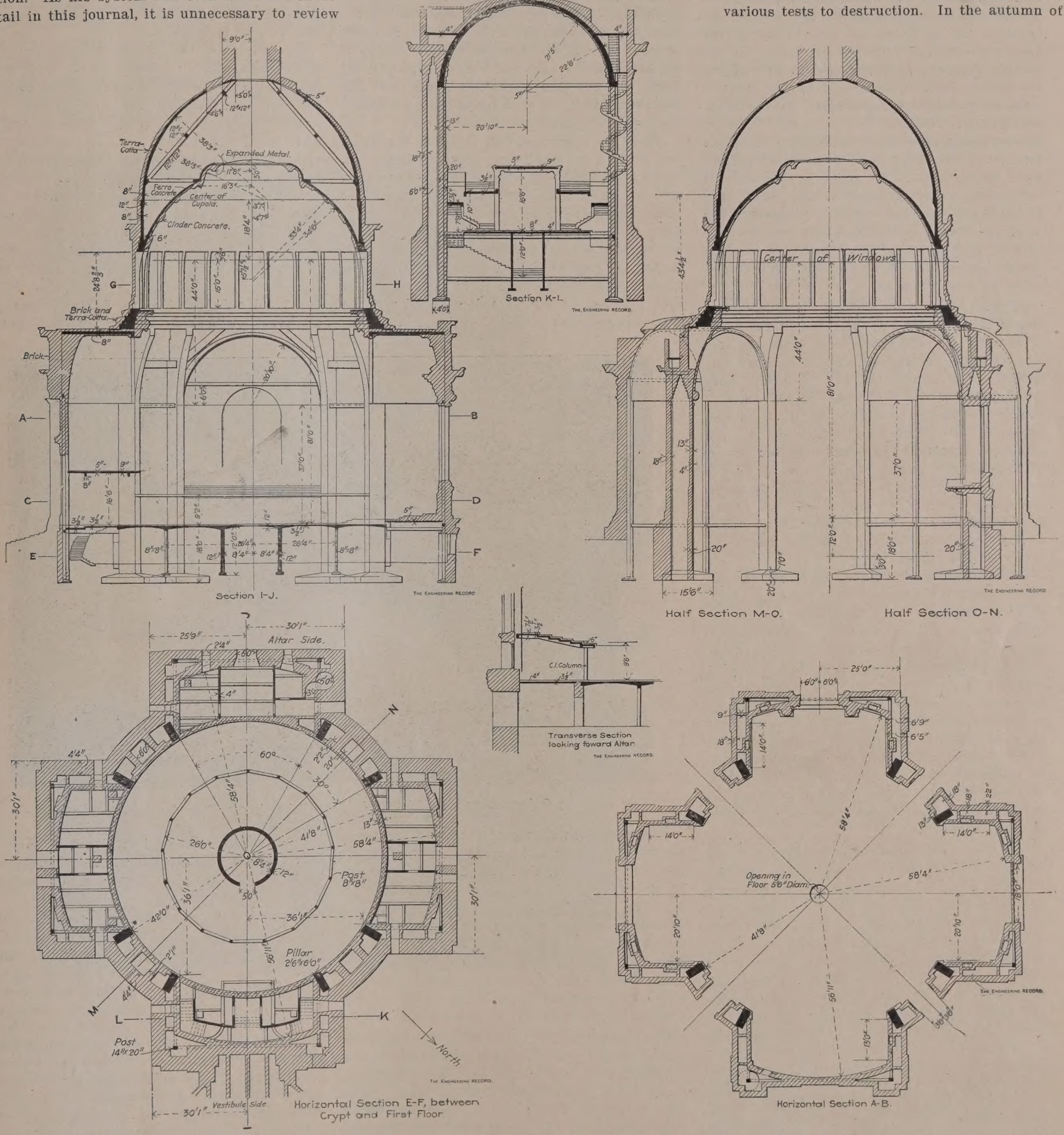
General Dimensions and Exterior Treatment of the Chapel of the U. S. Naval Academy.

Notes on European Reinforced Concrete Structures.

At a recent meeting of the Royal Institute of British Architects there was a valuable discussion of various features of designing and constructing buildings of reinforced concrete, in which both theoretical and practical topics were debated. The discussion was opened by a paper by Mr. W. Dunn on the construction and strength of reinforced concrete columns. He pointed out that the theoretical investigations of Prof. John Perry and the experiments of M. Considère had proved concrete would withstand a much greater compressive stress before rupturing when it was confined laterally than when it was free to expand on the sides. Considère's experiments showed that the resistance to rupture was increased in this way from about five to eight times. While it is impossible to use laboratory methods to prevent lateral swelling in the case of columns for actual use, an equivalent result has been obtained, Mr. Dunn states, by binding the columns with wire or straps.

In the Hennebique columns a wooden mold is first made in which vertical rods are set upright. These rods are then bound together near the bottom with wire or sheet metal and 6 to 12 in. of concrete is rammed in place. Another binding is then put on and the process repeated until the column is completed. The special functions of the vertical rods are to aid the concrete in resisting the compression due to the load, and to resist any tensile stress which may be set up in the concrete by unequal loading or lack of homogeneity in the material itself. M. Considère was probably the first, the paper stated, to design a column in which the transverse bindings were given their full consideration. As his system has been described in detail in this journal, it is unnecessary to review here Mr. Dunn's discussion of it. It is only necessary to say that M. Considère believes his hooped concrete column has an ultimate resistance exceeding the sum of (1) the resistance to crushing of the plain concrete, (2) the resistance of the longitudinal rods stressed to their elastic limit, (3) the resistance of imaginary longitudinals of which the volume is equal to 2.4 times that of the spiral reinforcement, also stressed to the elastic limit.

The strength of columns as determined by tests made by many experimenters was next taken up by Mr. Dunn, who concluded from these experimental results that the addition of iron or steel reinforcement to concrete columns made the strength of the latter much more definite; plain concrete has a very variably strength when mixed from the same materials and in the same proportions, while the strength of reinforced concrete is much less variable.



Section I-J.
Section K-L.
Half Section M-O.
Half Section O-N.
Transverse Section looking toward Altar
Horizontal Section E-F, between Crypt and First Floor
Horizontal Section A-B.

Location of Reinforced Concrete Portions of the Chapel of the United States Naval Academy.

A second paper read at the same meeting was a description of Hennebique reinforced concrete structures, and was presented by Mr. L. G. Mouchel. In the Hennebique practice the builders always test their structures, within a very few weeks after completion, with loads 50 per cent. in excess of the calculated load; they measure the deflection which, in the case of floors, rarely exceeds 1/1000 part of the span under test, although they always guaranteed it will not exceed 1/600 part; and they expect when the load has been removed that the floor will regain its former level, or, at any rate, that the deflection will be quite inappreciable.

From time to time Mr. Mouchel has made various tests to destruction. In the autumn of 1902 he was making foundations at Bermondsey. Some space being available on the property, at the suggestion of the architect and the engineer in charge of the work, he constructed a Hennebique beam on two common concrete supports. It was calculated in the same manner as he would have calculated the floor of which it was supposed to be a part—for a working distributed superload of 3 cwt. per square foot. Seven weeks after he rapidly put on that beam boxes filled with sheet steel, each weighing 2 cwt. until he had on it 12 tons, which represented twice the calculated load. At that moment the concrete pillars began to sink in the ground. The load was left on all night. On the following morning it was found that the pillars had sunk a little deeper. The loading operation was then resumed, after having taken precautions to avoid injury to the laborers engaged in the operation, and the weight having been increased to 30 tons, or five times the calculated load, the operation had to be stopped, the pillars being crushed, and having taken a slanting position, which caused the beam to twist badly. It was then discharged. The deflection was measured at that point, and on the morrow it was found that the floor had sprung back by one inch. He could have continued loading for a long time before arriving at complete destruction, had not the supports given way. The beam cracked, but was by no means ruined; it suffered far more from the twisting resulting from the failure of the pillars than from the load put on it.

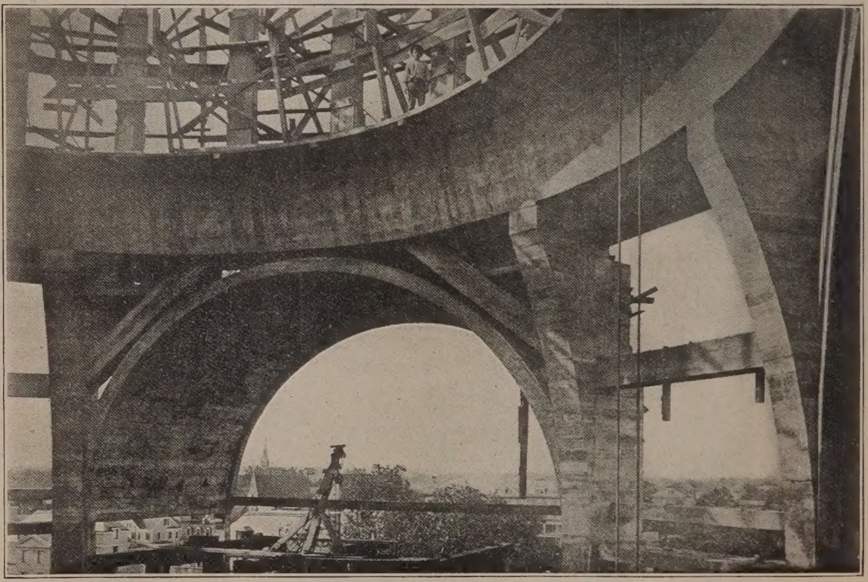
Several years ago the Hennebique engineers constructed at a colliery at Lens, in the north of France, coal bins about 40 ft. high, and containing 1,200 tons of coal. These bins are supported on ten pillars. One day, when they were quite full to the brim, a train of coal trolleys came into contact with one of the legs and broke it. It threw that corner of the bin structure suddenly in cantilever—an event which certainly had not been foreseen by the calculator; but owing to the monolithism of the whole building, no injury resulted to the silos themselves, nor to the other three pillars of that particular silo. We merely had to reconstruct the broken pillar.

Mention was made of a car-shed constructed at Le Mans, in France. The building is divided in two spans of 21 ft. by a central line of ferro-concrete pillars. One of the trams, having got out of control, came down the gradient leading to the shed (there is a sharp curve at that point), ran off the rails, and came in contact with the central pillar at the entrance of the shed and broke it. Through that accident the span instantly became 42 ft. instead of 21 ft., but, notwithstanding this, the beams supported by that pillar held perfectly, and did not show the least trace of strain; another proof of the safety due to the monolithism of the ferro-concrete structures.

One of the most useful applications of ferro-concrete, in Mr. Mouchel's opinion, is the construction of ferro-concrete piles. He constructs the piles very much on the same lines as a pillar. He calculates them as beams, since they will have to be lifted from the ground and made to take all sorts of positions while suspended from slings before being driven. He always endeavors to drive them with a heavy monkey, and gives them a very severe set. It rarely is more than 1 in. for the last combined 10 blows of the monkey. The drop is naturally regulated by the top weight which the piles are expected to carry. The size of the bars, the position of the links, are all regulated by the same considerations. Their cost is very little more than that of a timber pile, and they can take safely a weight so far in excess of what the latter can take (according to the ground in which they are driven; 14x14-in. piles can safely take a load of about 60 to 80 tons) that, on the total cost of a foundation, they effect a very appreciable economy.

A few of these piles have been broken when they were driven unreasonably by people who forget that there are limits to the elasticity of a ferro-concrete body. Recently, unaware to the engineers, one of these piles was driven for three whole days with a 30-cwt. monkey, and received no fewer than 10,972 blows without breaking. Mr. Mouchel protested, but too late. The vibrations caused by a heavy monkey on a ferro-concrete pile do not affect it in the least. Frequently, when they have reached their set after prolonged and hard driving, the engineers have to cut the concrete round the heads, that is to say, in the part which has been in the most direct contact with the monkey, in order to pass through the bars of the pile those of the beams which they will have to support; and when the pile has been well made, and the concrete is well set, it is found quite uninjured and perfectly sound and hard.

About six years ago, Mr. Mouchel was building a jetty at Woolston, near Southampton. Some of his ferro-concrete piles were too long, and the heads were sawn off—they were of no value, and were thrown into the river. Years after, the question of preservation of steel by by concrete having been raised in some quarters, he had the idea of making a search for some of these pieces, and to have them grabbed out of the river bed. They were demolished and the steel was found as when it left the mill.



Top of Main Columns and a Side Arch, Naval Academy Chapel, Showing Cantilever.

Experience has convinced the Hennebique engineers that oxide of iron cannot exist in contact with concrete, that rusted bars embedded in concrete will in the course of a month or so be as bright as new; the rust having been deoxidized with formation of a ferrite of calcium, which forms a protective skin around the bars. The concrete used in their ferro-concrete is markedly different from ordinary concrete, both in its composition, in its make, and in the way it is employed. It is composed of materials of small volume (three-quarters of an inch maximum for the gravel or stone), and the materials used are very clean. The proportions of sand and stone are always adjusted so as to give a concrete quite full, it is used in small quantities at a time, and so vigorously rammed that no cavities or porosity are at all possible. Mr. Mouchel repeatedly had pieces cut out of his work, weighed them, immersed them a long time in water, then weighed them again. The absorption was practically nil. The Hennebique engineers have made numerous water towers; the thickness of the walls of the reservoirs rarely exceeds 5 in.; they are perfectly water-tight, and this without the help of any lining, such, for instance, as asphalt.

The Strength of Treated Timber.

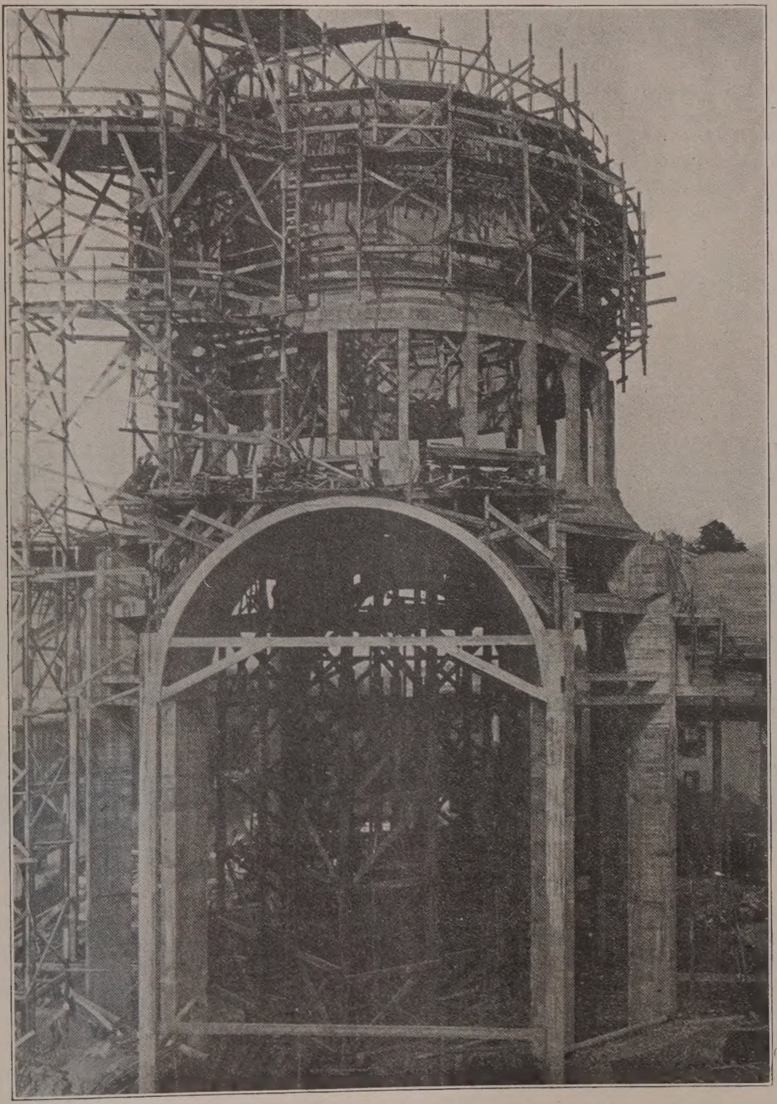
The timber laboratory of the Bureau of Forestry at St. Louis has been conducting studies during the last few months to determine the effect on the mechanical properties of wood of the steaming and preservative processes employed in treating the timber. The work has been under the direction of Dr. H. von Schrenk and Dr. W. R. Hatt, who have recently issued a preliminary report on the general results obtained.

The effects of the preliminary process were determined only on loblolly pine. Both green and seasoned timber was used in determining the effect of creosote and zinc chlorid. In making comparative strength tests of treated and untreated timbers, it is necessary to eliminate as far as possible the variations due to the great differences in quality of individual pieces of wood. This was accomplished in this case by using 11-ft. timbers cut at the same time from one forest site. In testing the influence of preliminary processes of seasoning, a 3-ft. section was cut from one end of each timber and sawed up into test pieces, which furnished a basis of comparison between (1) the results of tests on these "control" pieces, and (2) the results on test pieces taken from the remaining 8-ft. section after the latter had been subjected to the various preliminary processes in the treating cylinder.

In testing the effect of preservatives themselves the entire 11-ft. timber was subjected to the preliminary seasoning processes, after which a 3-ft. section was cut from the end of each timber. The 3-ft. section thus having been subjected to the preliminary seasoning processes formed a basis of comparison with the remaining 8-ft. section, which was treated with the preservatives. In this way the separate effects of the preliminary processes and the effects of the preservatives could be isolated and determined.

Because of an apprehension that defects of brittleness of treated timbers might not be evidenced by the ordinary tests under slowly applied loads, provision was made for both static tests and impact tests. The test pieces were subjected to crossbending strain, compression along the grain under both static and impact conditions, and under shearing parallel to the grain and compression at right angles to the grain under static conditions. The data taken include the moisture conditions, specific gravity, and rate of growth. During the treating operations, records were kept of the temperature to which the timbers were subjected at all stages, the amount of water lost or gained, and of the amount of preservatives absorbed, as indicated by gross weight and subsequent chemical analyses of the test pieces.

Ordinarily the strength tests were made immediately after treatment in the cylinder. In order, however, to determine what weakness might be introduced by changes in the physical condition of the preservatives in the wood through lapse of time, a complete series has been set aside for subsequent operations. An additional set of test pieces has been loaded with different percentages of the strength, as exhibited under the ordinary tests, and this load allowed to act for long periods of time, the deflections being measured from day to day.



The Reinforced Concrete Portion of the Naval Academy Chapel.

While this programme is not sufficiently advanced to allow the drawing of final conclusions, yet the preliminary results are fairly indicative of what may be expected. It is found that the steaming process weakens the resistance of the wood fiber to both static and impact loadings. It may be stated that this diminution of strength is very nearly in direct proportion to the length of time that any given steam pressure is applied. The diminution of strength was found to be 25 per cent. after a pressure of 20 lb. was applied for ten hours to green loblolly pine, and 10 per cent. when a pressure of 20 lb. was applied for four hours. This diminution of strength increased very rapidly when the pressure rose above 20 lb., and amounted to about 25 per cent. when a pressure of 50 lb. was applied for four hours. It will be seen that when the conditions of time and pressure are made very severe, the conditions prevailing in a pulp mill industry will be approximated.

With relation to the effect of preservatives themselves, the latter is distinct from the preliminary process. It may be said that the treatment with zinc chlorid does not seem to further reduce the strength of timber beyond the effect of the steaming process. This might have been expected when it is considered that the strength of the zinc chlorid solution ordinarily used does not exceed 2½ per cent. The strength of timber that had been treated with the 2½ per cent. solution of zinc chlorid after having been steamed four hours at 20 lb. pressure was the same as that of timber which had been steamed without the subsequent application of zinc chlorid. The same statement may be made of timber treated with an 8½ per cent. solution of zinc chlorid. It may be that subsequently the crystallization of the zinc chlorid will weaken the wood fiber. This remains to be determined.

The effect of creosote appears to be the same as that of an equal amount of water in weakening the fiber. That is to say, the strength of creosoted timber is that of green timber. The difference is that while green timber gains strength upon seasoning, the creosote oil remains in the wood, and, it appears from analysis of a pile 35 years old, that the oil remains in a liquid condition. Consequently, comparison between seasoned timber and creosoted timber will always result to the disadvantage of the latter as far as its strength is concerned. In the case of creosoted wood, it also remains to determine what changes in the wood fiber take place through lapse of time in the presence of creosote oil.

The Use of Water Meters in Cincinnati.

With the completion of the new water-works of Cincinnati, which will furnish a filtered supply, it will be necessary to restrict waste and to adopt an equitable system of rates. Mr. George H. Benzenberg, acting chief engineer of these new works, will recommend the compulsory universal use of water meters in order to attain these results. His views of this subject, which is of vital importance wherever costly filtered water is supplied, lends special interest to the following statement of his views:

"In nearly every small city and in almost all the large ones the use of meters has been enforced in recent years. While their use may, on first view, seem opposed to the consumer, it has been the experience that, after they have been in use, the consumers themselves have been their strongest advocates. With a meter a consumer pays for the water he consumes, not for what somebody else uses. He thus finds that he pays less than under the old method. In those cities that I have personally investigated or had to do with the consumption has been enormously reduced. This, of course, brings an immense saving to a city, for it does not have to pump so much water, and all bills, including those for administration, are reduced. Taxes and water rents can, therefore, be reduced. It also permits the use of water for purposes not otherwise possible.

"The man who uses a moderate quantity of water under any circumstances now has to pay for the water wasted by others, each and all being charged the same without regard to actual consumption, while with a meter each is charged according to benefits given.

"In Milwaukee it is a fact that no more water is used now than was the case 13 years ago, all due to the use of meters. There the people themselves are the most devoted to the meter. Cleveland has had the same experience, it having introduced meters on my recommendation three years ago. In those cities, however, the water is not treated, but if with them the use of meters has proven both popular and profitable to the city and to the people, how much stronger will be the case here when the water is to be treated by expensive processes? There can be no argument that I can conceive why meters should not be used when the new waterworks are completed. The city could not afford to go on allowing any and all to waste water, when it cost so much to give the people pure water."

THE RUN OF THE WESTINGHOUSE TURBINE of 600 h.-p. at the Louisiana Purchase Exposition was a performance of which the builders are naturally proud. It was started at 9.20 A. M. June 20, and stopped at 11.32 A. M. Dec. 2, making a continuous run of over 3,962 hours. During this time it supplied current for light and power throughout the Westinghouse exhibits in the Machinery, Electricity and Transportation buildings. After the run there were no signs of wear and the bearings still retained their tool marks. The speed maintained was 3,600 r.p.m., and the load varied from 25 per cent. below to 25 per cent. above the nominal rating.

The Boston Bridge Works.

The old wooden shops of the Boston Bridge Works (founded in 1876 by Mr. D. H. Andrews), situated at Binney and Sixth Sts., Cambridge, Mass., about 1½ miles from the Boston City Hall, were destroyed by fire in 1896. At that time the company had a number of important contracts on hand, and as soon as the wreck of the old works was partially cleared away, some of the heavier machines which had escaped total destruction, together with some absolutely necessary new machinery, were set up under temporary wooden sheds and work resumed on the old contracts and on such new work as the crippled facilities of the company would permit it to take. Plans for the rebuilding of the works were meanwhile gotten out, and although a new location was seriously considered, it was decided to rebuild on the old site, and of such materials and permanence as would prevent a recurrence of a similar catastrophe.

The building of the new shops, involving as it did the manufacture of the steel frame, the change of machinery from the old to the new foundations, the construction and installation of the new equipment, including the building of the electric cranes, was, as all this work had to be carried on while outside orders were being executed, a slow and difficult operation, and was only carried to a successful conclusion by the expenditure of much care and labor. The shops have now been in successful operation for several years, though improvements are being constantly made in the machinery and equipment, with a resultant economy in the construction of the various classes of work undertaken by the company. The capacity of the plant on a nine-hour daily turn is about 15,000 tons per annum of trusses, girders, columns and general bridge and structural work.

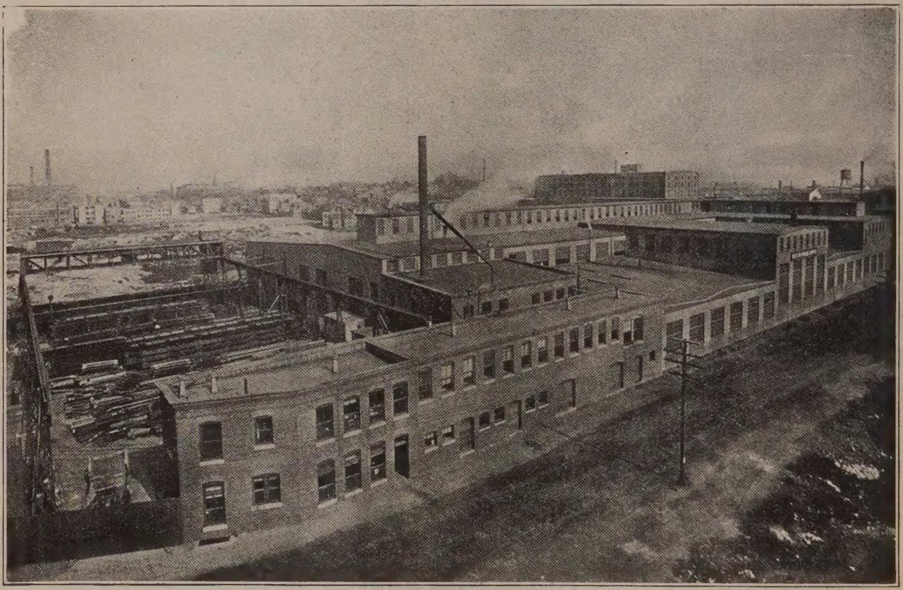
The plant occupies a total area of about 3¼ acres and is about 770 ft. in its greatest length. Facilities for receiving and shipping material are assured by sidings and several switches to the main line of the Grand Junction Ry. (a branch of the Boston & Albany R. R. connecting all the railroads having entrance into Boston), which runs along the lower end of the property.

The main shop is a steel frame structure with brick and concrete sides, 300 ft. wide and 308 ft. long, the roof being tar and gravel on plank. The framing is made with 14-ft. units, aggregated into three 56-ft. bays running across the shop, 200 ft. long, one bay 56 ft. wide and two bays 42 ft. wide in the lower portion of the shop. The 42-ft. bays are divided in their length by the line of columns supporting the crane tracks of the "girder shop," 50 ft. wide by 140 ft. long, running along the north side of, and included in, the main shop. On the south side of the west end of the main shop, and separated from it by fireproof partitions, are the machine shop and power house. The latter is a brick building separated by a spur track from another brick building, two stories high, containing the offices, drafting room and storage room for paint, tools, etc. Opposite the power house it is constructed over the underground coal-storage pit, which runs under the spur track mentioned above from the power house wall to the Binney St. line. The template room is contained in the second story portion of the first 56-ft. bay at the upper end of the main shop, and runs the entire width of the shop, 200 ft. Back of the template room on the second floor level of the second 56-ft. bay, and running through only a portion of its length, is the template storage room.

In front of the upper end of the main shop is the storage yard for plates and shapes. This yard is 130 ft. long and 220 ft. wide, extending out so as to include the Grand Junction Ry. track, which runs along the far side of the main shop. At the lower end of the shop is the storage yard for finished material, 110 ft. long and of a width equal to that of the shop, 200 ft., less that of the office building.

The template room floor is entirely unobstructed, and is lighted by windows on three sides and a portion of the fourth, as well as from a monitor running throughout its length. The room has a ⅞-in. maple floor laid on a 2-in. hard pine underfloor, and affords ample facilities for laying down full-size work of the largest dimensions. Around the four sides of the room are continuous benches for laying out small work and such templates as can be best handled there. The room is equipped with modern wood-working machinery, provided with a lavatory and closets, and heated by hot air forced in by a Sturtevant blower. Access from the shop floor below is had by means of a fireproof stairway.

The stock yard, 130 ft. long, at the upper end of the main shop, is traversed longitudinally by four narrow-gauge surface tracks running into and through the shop, and transversely by a 12-ton 100-ft. span electric traveling crane designated as No. 8. It has two independent trolleys, and commands the railroad track through the stock yard, thus permitting the rapid and economic unloading of cars and the distribution of stock to any desired point in the yard, as well as the loading of the narrow-gauge push cars which carry the material into the shop at the points where it is cut up, marked and punched. The bending and straightening rolls, 86 in. wide, are located in this yard in a position which permits of the straightening of material previous to its entrance into the shop without any unnecessary handling. A machine which cuts I-beams to length before their entrance into the shop is also located in this yard. The general plan of the yard provides for the storage of angles and other similar stock on one side of the yard, plates in the center, and beams and channels on the other side of the yard, adjacent to the unloading track. These locations correspond to those in the shop of the cutting and punching machines used on each class of stock.

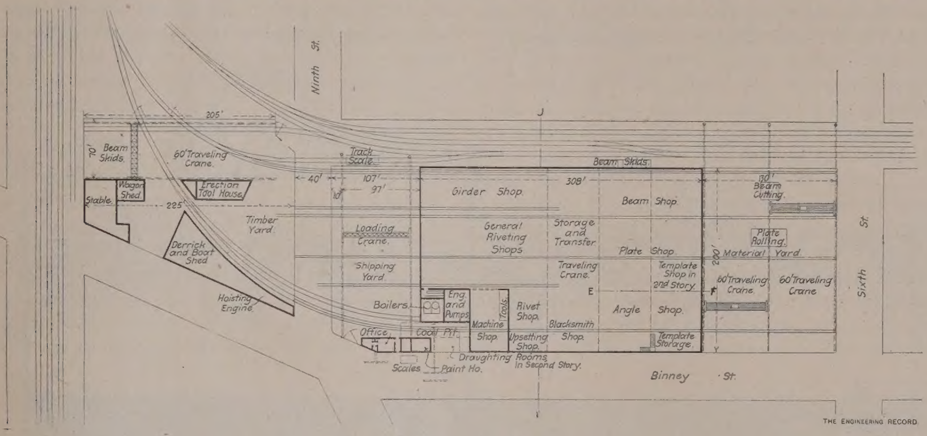


General View of Plant of Boston Bridge Works.

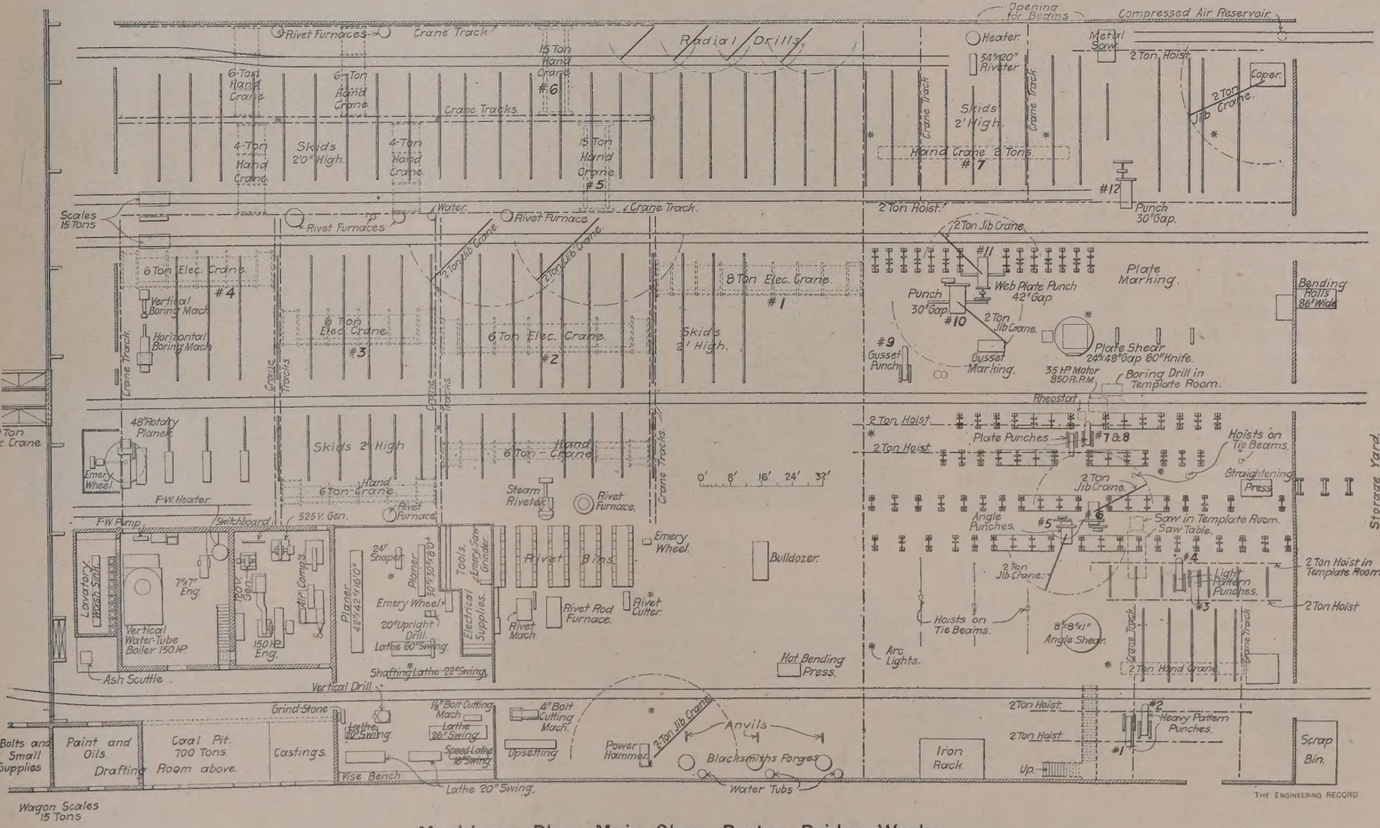
In describing in detail the layout of this shop it would appear to be the most logical method of procedure to follow the various classes of material in their progress through the several operations incident to their completion into a finished member, giving to each machine and operation as we meet it such description as may be thought interesting; and in the following this method has been adopted, picking up at the end such items as may have been overlooked.

The angles coming into the shop on push-cars are unloaded on the marking skids in front of the angle cutters by means of overhead hand hoists running on transverse tie beams or by means of a 2-ton hand crane, No. 8, which runs on and is geared to the bottom chords of overhead transverse trusses. They are there marked for length and passed through either of two Hilles & Jones angle cutters, a fixed double shear of 6x6x¾-in. capacity, or a 8x8x1-in. double shear, mounted on a turntable, to avoid the necessity of swinging long angles through a large arc in making skew cuts. After cutting, the angles are laid on the skids and marked, then picked up by the overhead hoists and carried sideways to the angle punches, of which Nos. 1 and 2 are horizontal lever punches, heavy pattern, served by overhead 2-ton hand hoists, and Nos. 3 and 4 horizontal lever punches, light pattern, served by overhead hand hoists, 2 tons capacity; Nos. 5 and 6 are Boston Bridge Works 24-in. gap vertical punches, heavy capacity, served by a train of rolls or by a 2-ton jib crane, and are also used for punching flange plates. Angle punches 1, 2, 3 and 4 are arranged in pairs to allow long bars to be punched in one flange and returned for the other flange parallel to themselves, without requiring them to be horizontally revolved; the B. B. W. punches 5 and 6 being arranged so that one leg of the angle is punched on the forward movement and the other leg on the return movement of the angle, thus aiding it in its progress to the transfer house. After punching the angles are carried longitudinally by means of overhead 2-ton hand hoists or the roll trains, into the transfer house.

Plates coming from the stock yard on push cars are unloaded by means of overhead hoists onto the marking skids, marked, picked up and taken sideways to the plate shear, which is a Long & Allstatter 24x48-in. gap, 60-in. knife machine, mounted on a turntable and driven by an electric motor. After cutting, the plates are taken sideways or forward to the punches, of which there are seven, 5 and 6 being the angle punches before mentioned; 7 and 8, vertical lever punches; 9, lever gusset punches; 10, Hilles & Jones 30-in. gap punch used for heavy work; 11, a Long & Alstatter web-plate punch, 42-in. gap. Of these punches, 5, 6, 7, 8 and 11 are served by trains of rolls with auxiliary 2-ton hoists hung from tie beams or jib cranes above; 9, for light gussets, is served by hand, and 10 by a 2-ton jib crane. These hoists and roll trains also permit the punched material to be readily run into the transfer house.



General Plan of Works.



Machinery Plan, Main Shop, Boston Bridge Works.

Beams, after being cut in the storage yard, are run into the shop on trucks, transferred to the marking skids by a 2-ton jib crane and marked. Those which have to be coped are picked out of the pile on the skids by the jib crane and swung 90 deg. to the Hilles & Jones No. 6 coper, then swung back onto the skids ready for the 30-in. gap Hilles & Jones beam punch 12, which is served by a 2-ton overhead hand hoist running lengthwise. They are taken by a 2-ton hand crane, No. 7, just below the punch, transferred sideways to a 54x20-in. Allen pneumatic riveter, painted on the skids, loaded on push cars, and delivered to the shipping yard. Arrangement is also made for letting down a portion of the side wall of the shop at this point, so that the beams can be loaded directly on the cars, instead of having to go through the shop.

All the operations of making, cutting and punching noted above are conducted in the first two 56-ft. bays of the main shop, the templates having been delivered from the second story over this portion by means of a chute situated about in the center of the width of the shop. Power for the machines in this portion of the shop is obtained from individual motors attached to the machines as noted, and by a large motor centrally located, driving the remaining machines by belts and shafting, avoiding the necessity of carrying counter-shafting across the runs of any of the electric cranes.

The transfer house mentioned above is the third 56-ft bay of the main shop, running its entire width, 200 ft. It is served by an electric traveling crane, No. 1, of 10-tons capacity. The function of the transfer crane is the picking up of punched material and delivery of same to the various riveting shops which are served by their own cranes. The transfer house and crane are also used for the assembling of pieces like drawbridge drums, end and center floor beams of draw-span, turntables, cranes, etc., which have to be fitted up complete with machinery before shipping, in order to insure perfect adjustment of the parts in the finished structure. In one end of the transfer house is located the blacksmith shop, which is served by a 2-ton jib crane; and in the other end, adjacent to the girder shop, are located the radial drills and reamers.

Below the transfer house and adjacent to the blacksmith shop is the rivet-making and bolt-cutting equipment and upsetting machines. The former consists of a coke furnace, an Acme machine, and a lever cutter, with adjacent storage bins. The bolt cutter is a 4-in. Acme machine, and upsets are made on a Boston Bridge Works machine furnished with a Morgan Engine Co. steam hammer, and equipped with a complete set of dies, upsetting up to and including a 3-in. rod.

Just below the rivet shop, and enclosed by a fireproof partition, is the machine shop, equipped with modern lathes, drills, boring machines and planers of capacity sufficient for the heaviest machine work likely to be encountered. A storage for tools is also partitioned off in this area. Power for the machine and rivet shops is taken from a counter shaft running direct from the engine room.

Beyond the machine shop and below the transfer house, covering the balance of the area of the main shop, are the riveting shops for the various classes of work. These areas are completely covered with skids for the fitting up of the members and the painting and temporary storage of the finished pieces. That portion just beyond the machine shop is devoted to finishing framed members, such as trusses, columns, chords, etc., and stringers, floorbeams and similar small girders. This 80x140-ft. area is divided into three bays of 56 ft., 42 ft., and 42 ft., respectively, the first two being each served by the 6-ton electric cranes 2 and 3, and a 6-ton hand-riveting crane, and the last by a 6-ton electric crane, 4.

The first bay is equipped with a Bement-

Miles steam riveter for heavy work and an Allen pneumatic riveter suspended from the hand crane. The second bay has only the second riveter suspended as above. After the members are riveted they are taken to the third bay, if necessary, for facing the ends or drilling pin-holes, etc., then painted on the skids, loaded on the push-cars and run out into the shipping yard. The last bay mentioned above is equipped with a Bement-Miles 48-in. rotary planer for milling ends, etc., a Miles horizontal boring machine, and a Harrington vertical boring machine. All shoes, pedestals, etc., are finished in this bay.

The girder shop, which is situated in the far side of the main shop running from the transfer house to the lower end of the building, occupies a space of 50 ft. by 140 ft., affording ample room for the construction of the largest girders. The crane equipment for this shop consists of two 15-ton electric cranes, 5 and 6, supported at one end by tracks carried on columns, and at the other by tracks suspended from the roof, thus dividing the 50 ft. width into two crane aisles of 25 ft. each, without obstructing the floor space. In each aisle are also two hand cranes which carry Allen and Pedrick & Ayer pneumatic riveters, and which can also be used in assisting the 15-ton cranes in handling exceptionally heavy girders. The riveters are hung from the hand cranes on counterweighted levers, which give a quick and easy adjustment in every direction. A standard-gauge track has entrance into the girder shop, allowing girders to be loaded directly on the cars if desired. This track, as well as the parallel track adjacent to it, affording exit for the finished material, passes over Howe scales of 15-tons capacity.

The power house is located in a separate brick building in the near side of the lower end of the main building, and is divided into two parts, boiler and engine room, with their floors below the level of the yard. The boiler room has an opening into the 700-ton coal pit situated under a portion of the office building, and into which coal is dumped directly from the cars. This pit is partially below high-tide level and is connected with a rain-water sewer, by means of which, in case of spontaneous combustion, the coal can be completely flooded, the water being afterward drained into a sump and run out through the sewer at low tide. The boiler room contains a 150-h.-p. Cahall vertical water-tube boiler, provision being made for the installation of a duplicate.

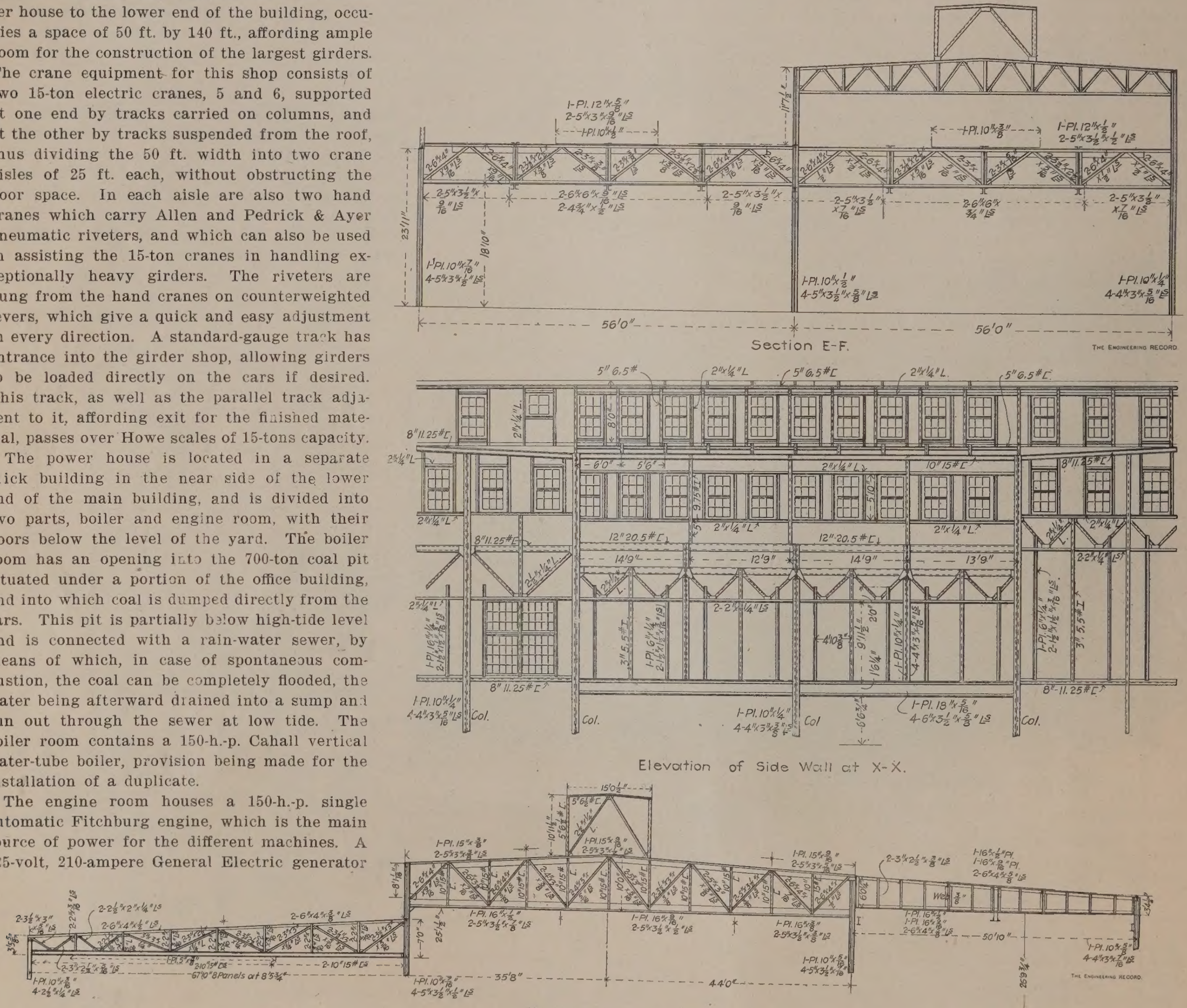
The engine room houses a 150-h.-p. single automatic Fitchburg engine, which is the main source of power for the different machines. A 525-volt, 210-ampere General Electric generator furnishes electric power for the cranes and motors throughout the shop, and the main countershaft provides power for the various other machines. A General Electric 120-volt, 240-ampere electric light generator, driven by the main engine, furnishes current for the arc and incandescent lamps in the shop. Two Ingersoll-Sergeant air compressors provide compressed air for the riveters and other pneumatic tools. The exhaust steam from the engine is supplemented by live steam when necessary and is used in the radiators located in the platform suspended from the shop roof to warm the air, which is driven by a Sturtevant blower through the overhead ducts to the template room and machine shop. A 7x7-in. Climax engine in the boiler room is provided as an auxiliary to drive the blower through cold nights. The blast for all furnaces and forges is provided by a fan blower located on a platform in the roof and driven from the counter shaft.

All the operations pertaining to the construction and finishing of a member are conducted with a view to decrease the cost of production, all movements of individual pieces are restricted to the smallest possible amount, and are always progressive, i. e., forward or sideways, but never backward, and are conducted with as little interference with other pieces as is practicable. Skids are plentifully provided for the reception of members between each stage of their progress, and for convenience in handling, but are arranged so as to take up as little valuable room as possible. Hoists, either hand or air, together with the numerous electric cranes, reduce to a minimum expensive handling by manual labor. The lighting of the shop is exceptionally well planned, the windows, as will be noted in the general photograph of the works, are large and numerous, and are glazed with ribbed glass, giving a well-diffused light throughout the interior. Abundant artificial light is provided by arc lamps supplemented in the template room and elsewhere as needed by incandescent lamps.

The general plan of the main building is such that it can be indefinitely extended sideways, as the transfer house, when continued, will allow of other shops being built into it without in any way decreasing the efficiency of the shop as a whole.

The shipping yard at the lower end of the main building is 110 ft. long and 20 ft. short of the full width of the shop (200 ft.), and is served by a 75-ft. electric crane, No. 7, with two 15-ton trolleys, all movements being commanded by a single operator in his cage at one end. The two trolleys permit of the piling of all members with exact regularity in positions parallel to the axis of the shop, thus materially increasing the capacity of the yard and also greatly facilitating the quick loading of long members, which are always placed exactly parallel to the axis of the car. The runway for this crane extends out beyond the shop over the Grand Junction tracks, allowing of the loading or unloading of cars without the necessity of bringing them into the yard in case the yard tracks are full.

Beyond the shipping yard and separated from it by Ninth St., is the wooden building devoted to the storage of erection tackle and



Section E-F.

Elevation of Side Wall at X-X.

Upper Part of Section I-J.

Framework of Main Building, Boston Bridge Works.

rigging, patterns, etc.; also the wagon sheds and stables, and racks for the reception of derricks, travelers and other plant. This yard is served by derricks, though it is planned ultimately to rearrange it, shift the buildings, and put in an electric crane for the easy and economical handling of erection appliances.

The drafting room occupies a 20x70-ft. space in the second story of the brick office building, with the office of the chief draftsman at one end and the blue-printing room at the other, lavatories, toilet room and coat room being beyond the chief draftsman's office. The drafting room has a center aisle with a row of tables on each side, each table being L-shaped, lighted by a single window, and provided with drawers and with an adjustable drawing board fitted with an automatic parallel straight-edge. The tables are each separated by a 6-ft. transverse pine partition, which is very convenient for tacking up various standards for practice and drawings for reference, etc. Provision is made for thirty-six draftsmen, besides those who can have tables in the office of the chief draftsman.

A foot bridge from the blue-print room provides access to the second floor above the engine room, which affords excellent fireproof storage space for drawings, files, etc.

Main Building, Looking toward Punch Shop.

Some details of the various machines in the shop are as follows: All the eight electric cranes in the plant were designed and built by the Boston Bridge Works. The inside cranes are equipped with General Electric motors, the yard cranes having Crocker-Wheeler motors. The transfer crane has a hoisting speed of 20 ft. per minute, with trolley travel of 100 ft. per minute, and a bridge travel of 200 ft. per minute; the other interior cranes have speeds of 20 ft., 100 ft., and 100 ft., respectively, for each travel. The two yard cranes are speeded to 20 feet per minute hoist, 100 ft. per minute for the shipping crane trolley, and 225 ft. per minute for the stock crane trolley, and 200 to 250 ft. per minute for the bridge travel.

Many of the machine tools, notably some of the punches, have also been designed and built by the Boston Bridge Works, and others have been altered and improved, among which may be mentioned the 60-in. plate shear which, originally a fixed machine, was mounted on a turntable, allowing easy operation by one man.

Special methods of handling the work have been developed in this shop with a view to economy of time and labor, among which is a scheme for planing the beveled surface of turntable track segments in an ordinary planer by bolting them to the planer bed and doing the work with straight cuts. In punching flange plates, they are first carefully straightened and then punched by means of a gauge instead of the ordinary method of prick-punching. A special device allowing the punching of stiffener angles has been evolved, as well as one for offsetting angles and "milling stiffener ends on a plate shear."

Some details of construction of the building itself follow: The building is located over an ancient, level, sandy beach, to which the column footings are carried; wall columns are connected by short sections of plate girders and the side walls built on them; the wall columns are spaced 14 ft. on centers, the walls being brick to a height of about 8 ft., and above that to the roof are of Portland cement concrete laid on expanded metal to a thickness of about 4 in., and supported by vertical and horizontal steel framing. There are two-tier or three-tier windows between the wall columns, all of which have steel mullions in the center and are glazed with factory ribbed glass. The long windows are divided into three sections, which can be opened and closed independently. The interior columns are arranged in five longitudinal lines forming bays 67 ft. 10 in., 36 ft. 8 in., 44 ft., and 50 ft. 10 in., and transversely four bays of 56 ft. and two of 42 ft. In that portion above the transfer house the columns are connected by longitudinal trusses, which support transverse trusses 14 ft. on centers, except that in the second story over the template room the transverse trusses between the columns support a vertical wall carrying longitudinal trusses 7 ft. on centers properly braced, over the template floor area.

In the storage bay, heavy transverse trusses run across the building, carrying the braced longitudinal trusses in the roof 7 ft. on centers, carrying also the track girders for the transfer crane, and providing partial framing for the side walls of the transfer house. Below the transfer house the transverse roof trusses are 14 ft. on centers and carry purlins supporting the roof planking, being themselves supported by longitudinal header trusses running from column to column. Those transverse trusses running in the line of the columns also support the tracks for the traveling cranes. In that portion of the roof over the girder shop, the light transverse roof trusses, and the center crane tracks, which run lengthwise, are carried on a heavy longitudinal box girder supported at each column by cross-girders.

The roofs are provided with only a slight pitch down from the main ridges, which are transverse over the template room and transfer house, and longitudinal over the balance of the building. A square room in the second story between the template room and transfer house has two free sides provided with windows. Monitors run transversely the length of the template room and longitudinally the length of the shop. The general appearance of the building is clearly indicated in the accompanying photograph. The framework of the shop is somewhat irregular, and is of moderate length span, with roof trusses of simple riveted construction, corresponding in general to those shown in section I-J through the girder and riveting shops. The longitudinal girder over the girder shop, carrying the tracks for two 15-ton cranes, is made with a pair of 5/16-in. webs 8 in. apart, connected by diaphragms about 3½ ft. apart. The arrangement of the trusses in the punching and cutting shops is shown by the sectional elevation E-F. The arrangement of a portion of the wall framing is indicated in the part elevation X-X.

There are about 800 tons of steel in the building, and it was erected by gin poles and derricks. The building was designed and equipped by the engineering department of the Boston Bridge Works, D. H. Andrews, president; M. F. Brown, chief engineer, and Winthrop Slade, superintendent.

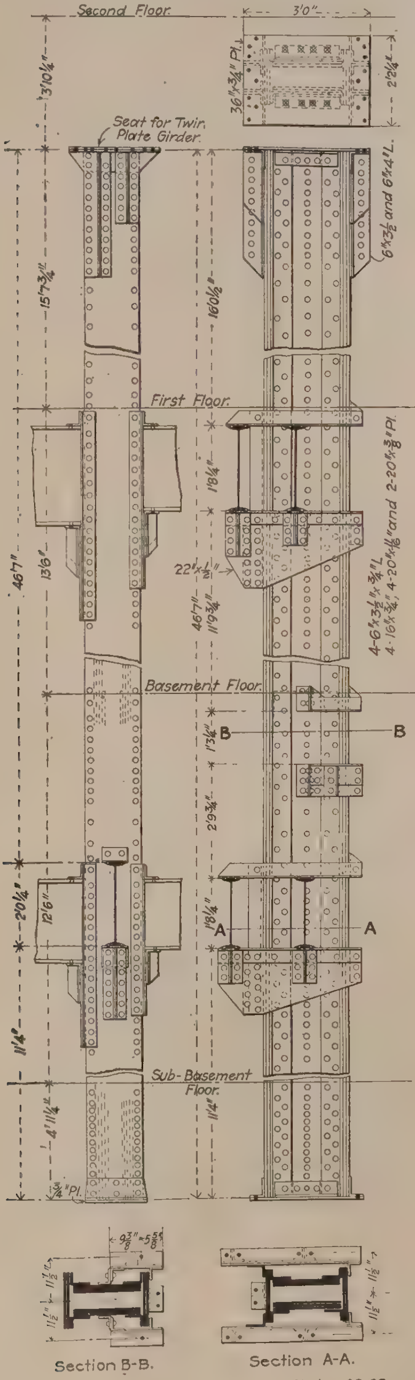
Water Consumption in Milwaukee.

The consumption of water per capita in Milwaukee, Wis., during the year of 1903 averaged 80 gal. a day, while the actual consumption per consumer was 87 gal. per day, according to the report of Mr. Charles J. Poetsch, city engineer. There were 46,545 services in the waterworks system, of which 36,415, or about 80 per cent., were metered, although only 46.3 per cent. of the consumption passed through the meter. The revenue received by the water department amounted to $41.62 per 1,000,000 gal. pumped. This amount contains, however, a small item for city or department credits. The actual cost of supplying water, based on the total maintenance cost plus the interest on the bonded indebtedness, was $18.87 per 1,000,000 gal. The total receipts of the department for the year were $399,211, of which about $183,000 were expended for maintenance, nearly $120,000 for construction and extension, the greater part of the remainder being applied to the interest and principal of the bonded indebtedness and to a sinking fund. It is stated that the water department has been self-sustaining since 1891, paying the operating expenses, interest on the indebtedness and maintaining a sinking fund.

PORTLAND CEMENT was made during 1893 in 78 different works, according to the U. S. Geological Survey. Twelve of these were in New York, thirteen in Lehigh and Nazareth counties, Pa., three in New Jersey, eight in Ohio, thirteen in Michigan, and the remainder in other sections. Pennsylvania was the largest producer, New Jersey next, and Michigan third, of the nineteen States having such plants. The total production is reported as 22,342,973 bbl. Natural cement to the amount of 7,030,271 bbl. was produced in 14 States. The lesson of the statistics is officially stated by the Geological Survey to be "that the producers of Portland cement will need to exercise care to keep from glutting the market and lowering the price of their product."

The Steel Framework of the Trinity Building, New York.

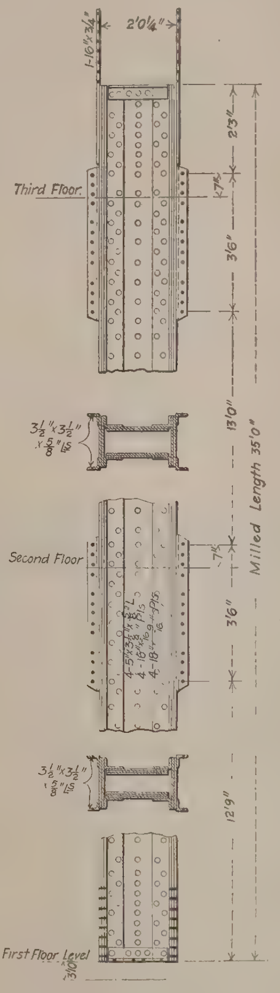
The Trinity Building occupies a site on lower Broadway adjacent to Trinity Church, and has a height of twenty-one stories, or nearly 300 ft., above the curb, and a depth of two stories, or about 23 ft., below it. It is nearly rectangular in plan, with street fronts of about 260½ ft. in Thames St. and 47 ft. on Broadway and Trinity Pl. The fact that it occupies the whole of one end of the block and overlooks the large open space of Trinity churchyard on the south side affords great advantages as to light and air, and insures its freedom from obstruction by any other buildings in immediate contact with it. The long and narrow plan is well adapted to its use for office purposes, because all rooms are lighted from outside windows and can be arranged on both sides of a long center corridor. No light courts are required and all of the floor space is available for use.



Section B-B. Section A-A.

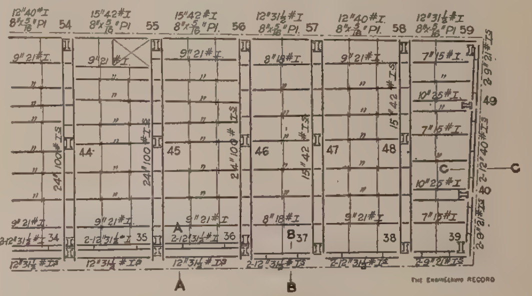
Column 20, supporting Second Floor Girder 20-29.

THE ENGINEERING RECORD



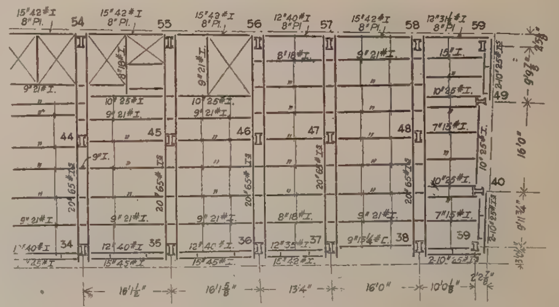
One of 32 Duplicate Wall Columns.

THE ENGINEERING RECORD

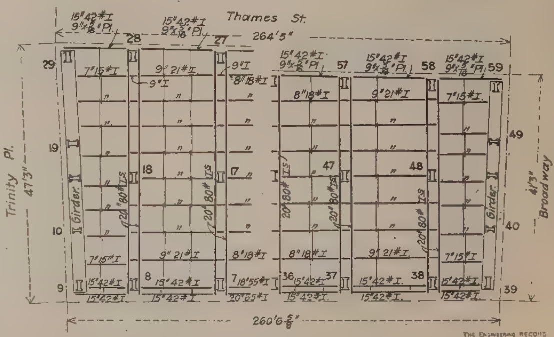


Part of Eighteenth Floor Beam Plan

THE ENGINEERING RECORD

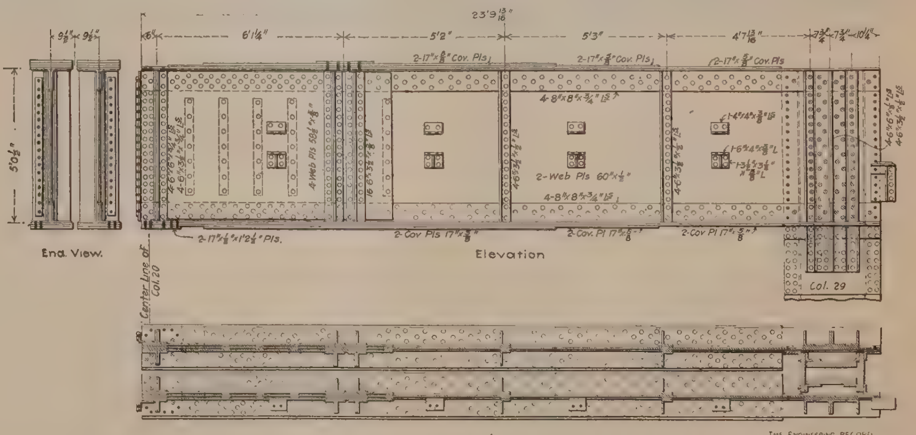


Part of Fourth and Fifth Floor Beam Plans.



Part of Second Floor Beam Plan.

THE ENGINEERING RECORD



Horizontal Section Second Floor Girder 20-29

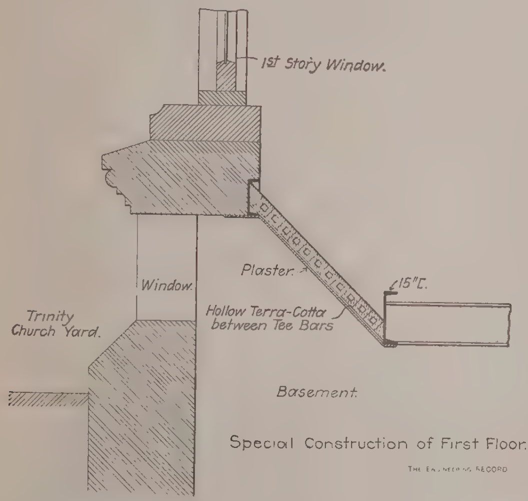
THE ENGINEERING RECORD

Special Beam Plans, Columns and Superstructure Girder, Trinity Building.

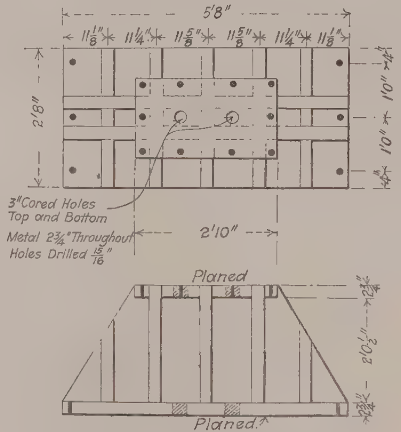
The superstructure is of the steel skeleton type, thoroughly fireproofed and supported on fifty concrete piers built in steel and wood pneumatic caissons and cofferdams, as described in The Engineering Record of Sept. 3, 1904. They support single columns, except those at the corners, which each carry two columns. The tops of the piers are leveled off 4 or 5 ft. below the basement floor, and are covered in the case of the wooden caissons with grillages of 20 and 24-in. I-beams, and in the case of the steel caissons with single cut-stone granite blocks.

The pedestals and grillages are depressed far enough below the cellar floor to permit the cast-steel pedestals for the columns to clear the under side of the floor, and the bases, pedestals and grillages are enclosed in 8-in. brick walls above the tops of the cofferdams. The grillage beams are bolted together, and are set with their upper flanges in contact with ⅞-in. cap plates and then maintained permanently in position by grout and concrete filled between their webs and around them. The cast-steel pedestals were carefully leveled with narrow shims on top of the granite pedestals and enclosed by clay dams. The spaces of about 1 in. between the granite and the pedestals were then filled with neat Portland cement grout poured in through holes in the cast-steel bases. A maximum pressure of 30 tons per square foot is allowed on the grout. The columns were set on their cast bases 12 in. below the finished floor level, and the concreting was then completed around them.

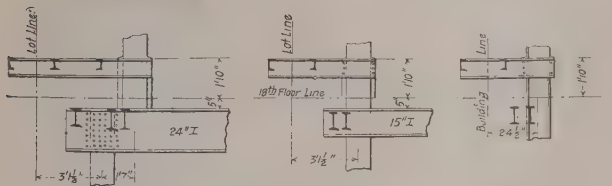
The framework is proportioned for a wind pressure of 30 lb. per square foot on the vertical surface, and the stresses from it are provided for by deep horizontal transverse beams. These are continuous across the full width of the building, and are connected to the columns by very wide and heavy gusset plates which take the place of kneebraces or diagonals. The first floor is proportioned for a total load of 250 lb. and the roof and upper floors for 175 lb. each; the floor is assumed in both cases to have a dead load of 95 lb. per square foot. The columns are proportioned to carry the full load from the upper story and for a successive diminution of 5 per cent. in each of the lower floors down to the tenth, where the increment for it and the floors below is reduced to 50 per cent. of the total load, as provided for in the New York building regulations. The framework is built of medium open-hearth steel, which is proportioned for maximum flange stresses of 16,000 lb. in I-beams and 14,000 lb. in riveted girders. The maximum column stresses are computed by the formula: Stress equals $15,200 - 58(L \div R)$, where L is the length of the column in inches and R the radius of gyration. The grillage beams are calculated as double cantilevers uniformly loaded.



Special Construction of First Floor.

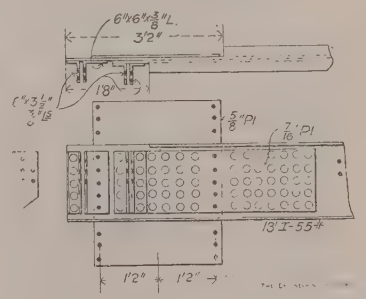


Cast-Steel Base for Column 24.

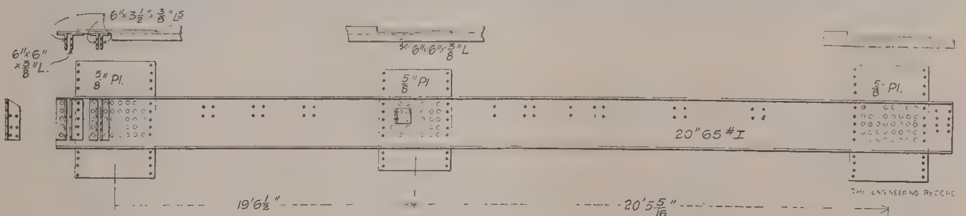


Section A-A Section B-B Section C-C.

Offset Columns and Balcony Cantilevers.



Connection at End of Floor Girder and Wind Strut in Sixth Tier.



Half of a Fifth Tier Floor Girder.

Framing Details and Column Base, Trinity Building.

The framework of the superstructure is very simple and regular, and consists substantially of 23 tiers of beams and girders supported on 52 lines of rectangular columns about 325 ft. in total height, which have rectangular closed cross-sections made with two channels and two cover-plates. The floors are made with 10-in., end-construction, hollow terra-cotta arches of about 5 ft. span which are covered with 6 in. of 1:2:10 Portland cement cinder concrete and a maple wearing surface. The floor arches are carried in general on 9-in. 21-lb. longitudinal I-beams web-connected to transverse girders. The latter are made in pairs riveted across the faces of the columns on opposite sides so as to impose balanced loads on them. Special framing is provided on the north side of the building around the elevator shafts and stair wells. The brick and stone exterior walls are carried on single and double I-beam girders in every tier of the floorbeams. In both ends of the building the requirements of window and door spacing make it necessary to place some of the upper-story columns off the center of those in the lower stories; this is accomplished by the use of a number of heavy double-webbed transverse plate girders, which afford seats for the upper columns between their bearings on the lower ones. The position of these girders and the relative arrangement of the floorbeams in both ends of the building are shown in the part plans of the second floor tier.

The framing in the sixth, seventh and eighth floors is typical of all the upper floors, and most of the others vary from it chiefly in the arrangement of the wall girders to conform with the requirements for the belt courses and other architectural details. Five of the elevator wells nearest the Broadway end of the building, some of which are shown in the fourth and fifth floor plans, terminate at the eleventh floor, and the space above them is utilized for additional office room. At the eighteenth floor there is a projecting balcony, and the columns on the churchyard side are offset inwards about 20 in. at this level, as indicated in the part plan, which also shows a special arrangement of triple wall girders to carry the balcony floor. The eighteenth-story offset columns are seated on the top flanges of the pairs of transverse girders, and to them are anchored the inner ends of the cantilever balcony beams about 15 in. clear of the girders. At the ends of the side walls the columns are not offset and the balcony beams are shorter than in the middle of the wall. On the Broadway and Trinity Place fronts, the balcony is still narrower and is supported from the regular columns. In all cases the wall girders are carried by the main transverse girders independently of the balcony girders. The balcony cantilevers are all proportioned to transmit their entire stresses to the columns, but a fulcrum support is provided for them on the walls of the building as an additional precaution.

Up to and including the eleventh tier, the transverse girders are made in single pieces nearly 44 ft. long, extending continuously across the three rows of columns nearly from face to face of the outer walls. Up to and including the fifth tier they are made with pairs of 20-in. 65-lb. I-beams, each of which has the top and bottom flanges cut on one side to allow the webs to be shop-riveted to deep $\frac{5}{8}$-in. cover-plates on the columns. These plates are designed with sufficient rivets to resist all distortion, and are made to come within the fireproofing lines, so that they do not occupy any extra space in the building. From the sixth to the eleventh tiers, inclusive, the transverse girders are made with pairs of 18-in. 55-lb. I-beams cut, as above described, to fit the columns, and reinforced at both ends with outside web-plates, as indicated in the detail. In the eleventh tier and above it the girders are made with pairs of 18-in. 55-lb. I-beams spliced near the center column, except in the eighteenth tier, where 24-in. full-length I-beams are used and cantilever beyond the wall columns to carry the balcony. In all cases the girders are shop-riveted to the short sections of cover-plates field-riveted to the columns. Both ends of the girders project a few inches beyond the edges of the wall columns to carry all wall girders. At the churchyard ends they have two pairs of short vertical angles shop-riveted to their webs to receive between their outstanding flanges the field-riveted webs of the wall girders. At the opposite ends they are provided with open holes, through which are field-riveted the connection angles shop-riveted to the wall girders.

The walls have a thickness diminishing from 3 ft. in the basement to 20 in. at the top and are made with red brick faced on the Thames St. side with 8 in. of ashlar limestone and lined with a 3-in. terra-cotta furring. They are supported on pairs of I-beams generally 12 in. deep and about 1 ft. apart on centers, except on the Thames St. side, where they are supported on single 12 and 15-in. I-beams with 8-in. top flange plates. In the second-story the extra heavy walls are carried directly by the plate-girders in the ends of the building and by pairs of 18 and 20-in. wall girders on the churchyard face. There are about 1,000 window lintels, which are generally pairs of 3 to 6-in. angles riveted together back to back and resting on the masonry just above the window frame with one flange projecting from the inner face of the wall to support the furring.

The heavy girders carrying nineteen stories of upper columns in the ends of the building weigh about 14 tons each and are substantially like girder 20-21 at the Trinity Place end of the building. This consists of two entirely independent twin girders, with their webs field-riveted at one end across the cover-plates of the wall-column and their bottom flanges seated at the other end on the cap of an intermediate column, which also supports a short girder continuing this one to the opposite side of the building and web-connected to it through the end stiffener angles. Each half of the girder is made with a single 60x½-in. web-plate and a pair of 8x8x¾-in. angles in each flange, one of which is full length and the other is cut to clear the wall column. The flanges are each reinforced with three 17x⅝-in. cover-plates of different lengths. The intermediate column base extends across the full width of both girders and is seated on separate bearing plates riveted to the top flanges. Underneath these bearings the webs are reinforced on each side with double pairs of stiffener angles and fillers, practically making short columns proportioned for the maximum shear developed at this point. At the wall end the solid-web bracket projects from the end of the girder to receive the single wall girder outside of the column line.

All columns have in the twenty-first story a uniform cross-section made with two 10-in. 20-lb. channels and two 16x5/16-in. cover-plates, with a total cross-section of 23 sq. in. and loads of 60 to 114 tons. The extreme dimensions of the columns remain nearly constant throughout their entire length to their footings and the cross-sections are increased as required in the successive stories downwards by variations in the thicknesses of the materials and in the lower stories by substituting built for rolled channels. The maximum cross-section in the basement tier is 200 sq. in. for column 24, which has a possible load of 1,200 tons. The minimum basement section is 74 sq. in., for a column with a possible load of 492 tons. All columns are made in three-story lengths, except for the three lower sections, which are each two stories long. They are all spliced with horizontal diaphragms and connection angles, and with pairs of jaw plates shop-riveted to the covers on the lower section and field-riveted to the lower ends of the upper sections. Both ends of all column sections are milled, and the lower ends of the bottom sections have base-plates riveted to them and bolted to cast-steel bases, which have horizontal top and bottom plates and longitudinal transverse and diagonal vertical webs distributing the pressure over increased areas. These bases are of two types, one of which is square in plan and is used with the granite pier caps, and the other is oblong, and serves essentially as a distributing girder engaging the tops of all the beams in the grillage. Both of them are secured by anchor bolts through the bottom plates, which have large grouting holes bored in them.

The column connections are very simple, and provide in most cases only for the transverse girders, the longitudinal floorbeams being connected to the girder webs independently of the columns. The girder connections are field-riveted to special vertical angles on the cover-plates of the columns, as indicated in the typical view of interior columns. The wall columns correspond substantially to the interior columns. The columns which carry the heavy plate-girders are special, and are essentially like column 20 except for variations required for different beam and wall girder connections. This column receives on its cap the abutting ends of two pairs of twin girders, and has vertical distributing angles to support the concentrated loads and transfer them to the web. Cantilever side-plates are riveted across the faces of the built channels to receive the wall girders, and shelf connections are riveted to the cover-plates for the longitudinal beams. In all regular columns the splices are made 2 ft. 10 in. above the finished floor level and are calculated to take all of the bending load from the wind pressure. All columns and beam and girder flanges are protected by hollow terra-cotta blocks 3 in. thick which are wired on, anchored if necessary, and set in a mortar of neat Portland cement.

The first or main floor of the building is 2 ft. above the Broadway curb and about 2¼ ft. above the level of the ground in the adjacent churchyard. In order to secure light from the churchyard for the basement story a special construction was adapted for the first floor framing. The wall girders were omitted at the first floor level so that the head of the window could project as high as that level, the soffit of the window sloping down, so that at the inside of the wall it is at the basement ceiling level. This slope was made of tees and angles, filled in with terra-cotta blocks.

The transverse girders were cut short so as to leave a space between their free cantilever ends and the inner face of the wall masonry. Their ends were connected to longitudinal channels like fascia girders, and corresponding parallel channels at a higher level were built into the inner face of the wall masonry. These two lines of channels serve to support a series of inclined 3x2½-in. T-bars 25 in. apart, on which is laid a sloping surface of hollow terra-cotta blocks. The under side of this inclined surface is plastered and forms an extension of the basement ceiling, rising up enough to clear the low windows built in the side walls just above the churchyard grade, as indicated in the sectional detail.

The steel work was erected, as described in The Engineering Record of Dec. 3, 1904, by means of three boom derricks, which were moved up with every third tier of beams. Great care was taken to check absolute verticality and alignment in the columns by frequent instrumental observations, and to maintain it accurately by the use of diagonal braces and ties. All field connections were riveted and no permanent bolts are left in the framework. The building contains about 4,800 tons of structural steel and 125 tons of cast-steel column bases.

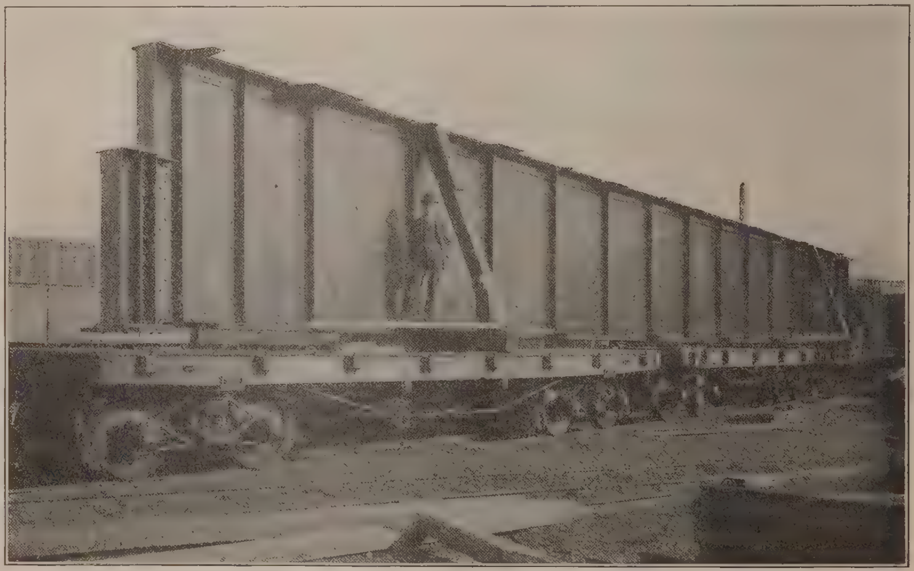
Mr. Francis H. Kimball is the architect and Mr. S. C. Weiskopf is the consulting structural engineer of the building. The structural steel was furnished by the Carnegie Steel Co. and erected by the George A. Fuller Co., general contractor, Mr. A. M. Ganson, superintendent.

Two 160,000-Volt Transformers of 50-kw. capacity have been built by the General Electric Co. for testing insulators for the transmission lines of the Columbia Improvement Co.

A 100-Foot Plate-Girder Span with Unusual Bearings.

Bridge No. 274C of the Canadian Pacific Ry. is a viaduct about 1,200 ft. long and 120 ft. high, at Ship Pond Stream, Me. It is a single-track deck structure with 30 and 60-ft. alternating spans carried by twelve 30-ft. riveted towers, except at the center, where there is a 100-ft. span over the water. The spans have recently been replaced by new plate-girders on the old towers, and the accompanying drawings illustrate the typical features of the new 100-ft. span, which is built with the upper corners of the web recessed to afford seats for the adjacent 30-ft. girders. The girders are 102 ft. 4 in. long over all, have a depth of 9 ft., back to back of angles, are cambered ¾ in., and are spaced 10 ft. apart on centers.

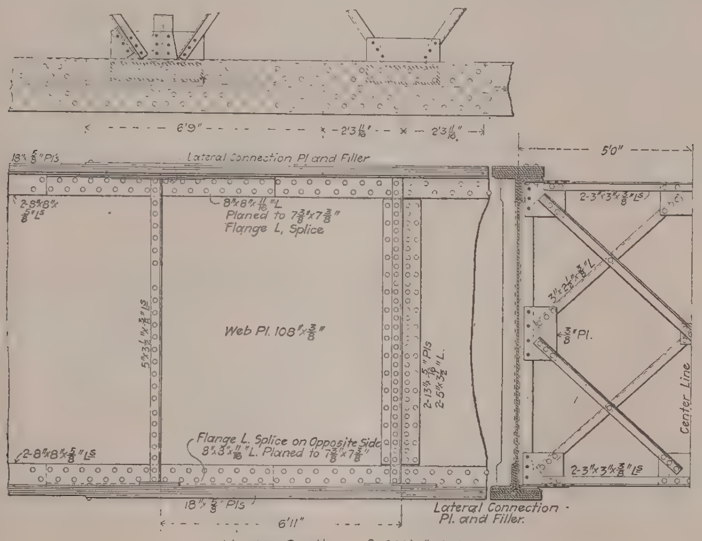
The webs have a uniform thickness of ⅜ in. and lengths of 165½ in., and the splices are uniformly made with a pair of 13x5/16-in. cover-plates with one hundred and twenty ⅞-in. shop-driven rivets in four vertical rows, exclusive of the rivets through the flange angles, which are continuous across the web splices. The flanges have a maximum cross-section composed of two 8x8x⅝-in. angles, four 18x⅝-in., and one 18x11/16-in. cover-plates, one of which extends the full length of the girder and is made in two pieces about 49 ft. and 53½ ft. long, which are spliced at the joint by the overlapping end of the outside cover-plate. The flange angles are each made with one piece 58 ft. 1¼ in. long, and one piece 44 ft. 2⅜ in. long, the joints being opposite each other in the top and bottom chords and staggered on the opposite sides of the web. Each joint is spliced by a single 8x8x11/16-in. angle 6½ ft. long, planed down to 7⅜x7⅜ in. wide.



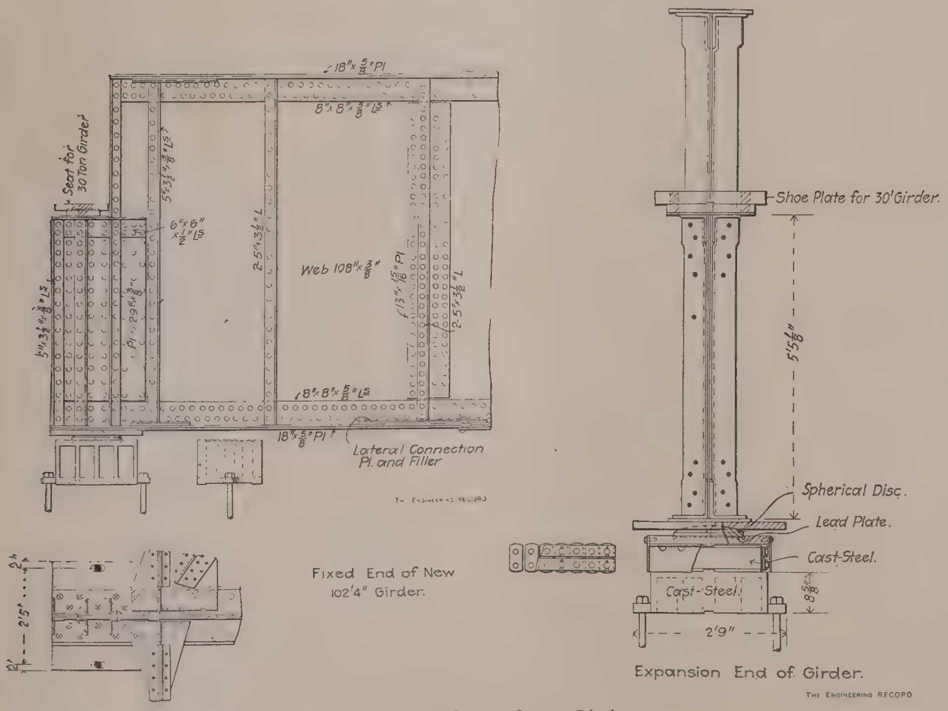
Girder 102 Ft. Long, 9 Ft. Deep, and Weighing 32 Tons.

The girders are divided into panels of a uniform length of 6 ft. 11 in., except at the ends, where they are shorter, by pairs of 5x3½-in. vertical angles, which are crimped, except at the splices and at the ends. At the ends and at alternate panel points, which are intermediate between the web splices, the girders are connected by vertical transverse sway-brace frames made, as indicated in the half cross-section, with four panels of X-brace angles. At every panel of the girder horizontal connection plates are riveted to the inner sides of the flange angles to receive the zig-zag top and bottom lateral bracing, which is made with single angles from 3 to 6 in. wide. The connection plates at the intermediate panels are riveted to the sway-brace frames, and all of those in the top system have fillers between them and the lower flanges, so that the ties will not have to be cut to clear the lateral angles. The lateral angles are in reverse directions in the upper and lower systems, so that their planes intersect in each panel.

At the ends of the girder the webs are reinforced by side-plates and additional vertical stiffener angles to resist the end shear and form adequate compression members between the bearings of the 30-ft. girders and the main bearings on the towers. The horizontal angles forming the seats for the 30-ft. tower girders have riveted steel cap-plates on which are seated planed bed-plates with longitudinal guide ribs on the center line. These engage corresponding shoe-plates riveted to the ends of the 30-ft. girders and secured by 1¾-in. bolts through slotted holes at the expansion end and through round holes at the fixed end.



Middle Section of 202'4" Girder.



Fixed End of New 102'4" Girder.

Expansion End of Girder.

Details of Long Span Girder.

The bearings for the main girders are of a special type adopted as standard by the Canadian Pacific Railway Co., and designed to provide full and accurate bearings, regardless of deflection or any minor irregularities of level and alignment. These consist of spherical convex and concave surfaces, which provide considerable adjustment for the girders and are used instead of pin bearings. They dispense with ordinary shoes and pedestals and are seated on bolsters and regular rollers at the fixed and expansion ends, respectively. The sole-plates, countersunk-riveted to the girder flanges, are of rolled steel 1¾ in. thick, and project 7½ in. beyond the edges of the flange. A spherical recess with a radius of 19⅝ in. is bored in the center to a depth of 1 in., and a 3-in. hole is bored through the remainder of the plate on the center line. The recess engages the upper surface of a cast-steel disk of corresponding convexity and 15 in. in diameter. This disk has a total thickness of 2½ in., and the lower edge is cylindrical and is seated in a recess bored in the upper side of the cast pedestal at the fixed end and in the top of the upper roller-bearing plate at the expansion end. In either case it is secured by a vertical center bolt with countersunk head, which is tapped into the roller-plate or pedestal.

The roller-plate is made with a center guide strip, and the four edges are curtained by the vertical flanges of two transverse angles riveted to the ends of the plate and by vertical plates tap-bolted to its sides. These together form a tight enclosure for the nest of seven segmental rollers. The rollers are made with vertical sides, precluding the possibility of locking together when deflected from the vertical. They are seated on cast-steel pedestals 8⅝ in. high, which are made with longitudinal and transverse vertical webs, but have no horizontal base-plate. The lower edges of the webs take bearing on the tower cap and are grooved to engage the guide strip provided there for the old girders. The pedestals under the fixed ends of the girders correspond to those under the expansion ends, except that they are 5⅛ in. higher, to compensate for the differences in the bearing, and are recessed on top to receive the spherical disks.

Each girder weighed nearly 32 tons and was riveted up complete in the shop and shipped on three cars, the center one acting only as an idle spacer. The girder took bearing at two points only on 12x12-in. transverse timbers about 10 ft. from each end, which were seated nearly in the centers of the end cars, with steel bearing-plates on segmental flat-steel tracks bolted to the car decks. The center of the timber was pivoted to the center line of the car with a vertical bolt countersunk on top to clear the flange of the girder. At one end of the girder the pivot pin engaged a slotted hole in the car floor to allow for longitudinal displacement of the girder. The girder was maintained in a vertical position by pairs of 12x12-in. knee-brace timbers fitted under the top flanges and connected together across them by bent plates. The lower ends of these braces are scabbed with short pieces of plank to the ends of the sills, and the latter were braced longitudinally by horizontal bars of flat steel with twisted ends bolted through open holes to the lower flanges of the girder, as indicated by the view of the girder loaded on cars at the bridge shop.

The girder was designed by the engineering department of the Canadian Pacific Ry., Mr. W. F. Tye, chief engineer; Mr. C. N. Monsarrat, engineer of bridges. The contractor was the Boston Bridge Works, Mr. D. H. Andrews, president; Mr. M. F. Brown, chief engineer; and Mr. J. C. Moses, engineer of construction.

THE STOLZE GAS TURBINE, developed by Dr. Stolze, of Charlottenburg, Berlin, was referred to recently in the "Engineering Review" of London. The original patents, it appears, were applied for in 1873, but were not delivered until 1897. Two separate turbines are mounted on a common shaft, one serving as a rotary air pump and the other constituting the working turbine proper. Both approach, in mechanical construction, the steam turbine, having fixed guide passages placed against the rotating disk, which is rigid with the shaft. The air furnished by the compressor passes through a heater utilizing the heat of the exhaust gases, then into a combustion chamber, and finally a part is conducted over a generator for gasifying the combustible in order to supply a combustible gas for the operation of the turbine. The gas products from the so-called generator enter the combustion chamber, where they are burned by contact with the air. The products of the combustion pass into the turbine proper, where they develop work by expansion through the passages of the machine. The cycle of operation is thus compression, mixture with combustible, combustion, expansion and exhaust. In this case, like that of the Diesel motor, compression precedes the mixing. The turbine thus far constructed is an experimental machine, but it is said that the results have been satisfactory and a 200-h.-p. turbine is now being constructed.

The Mechanical Plant of the Bellevue-Stratford Hotel, Philadelphia.—III.

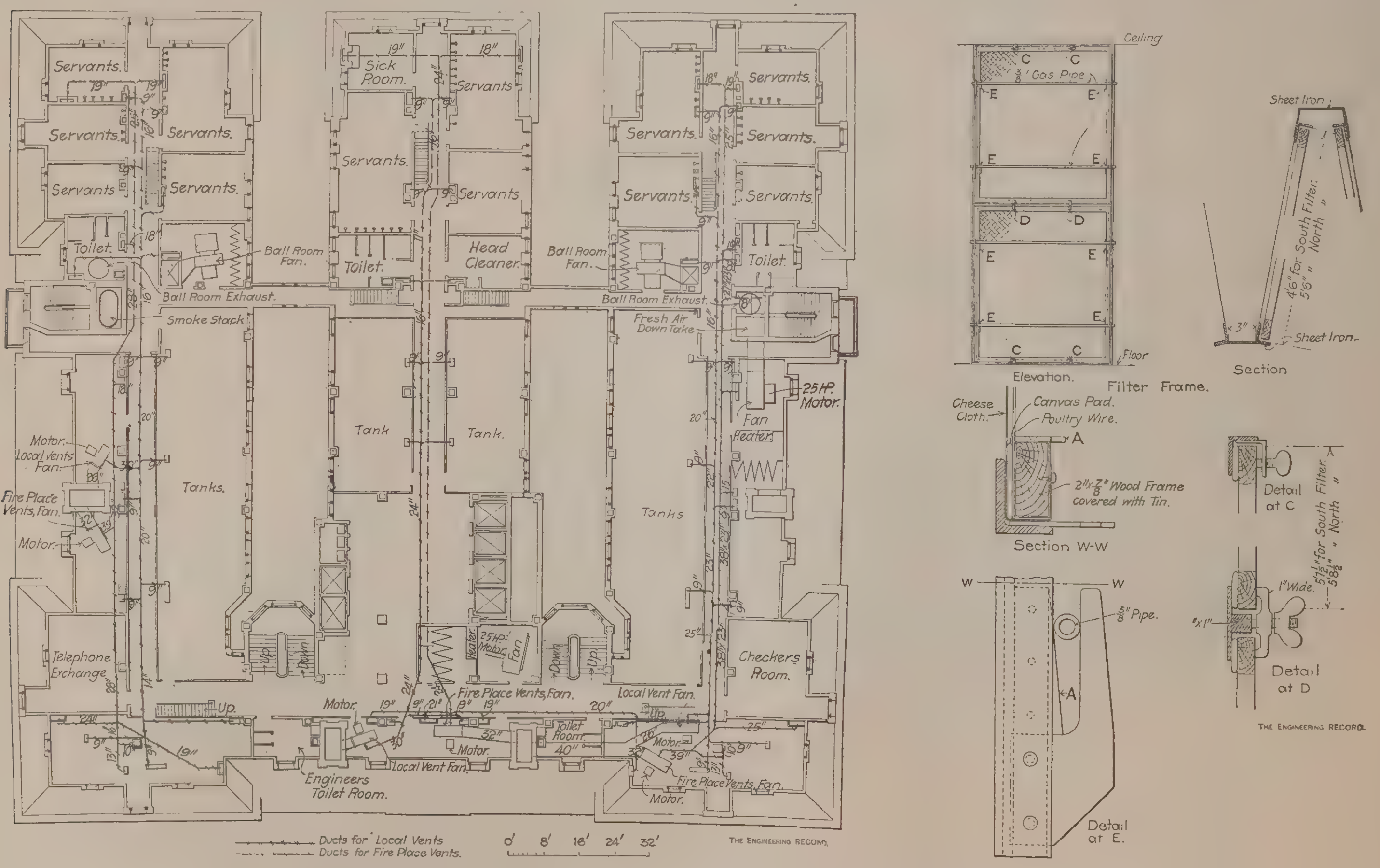
Ventilation.—For ventilation there are 20 fans, mostly of the centrifugal type, all electrically driven from motors which aggregate in capacity 194 h. p. A noteworthy feature is that some of the fresh-air fans are located in the seventeenth story of the building, where inlets were provided in order to secure the best possible quality of air, and that these fans discharge tempered air downward through shafts terminating in the lower stories of the building, where the air is reheated, either by passing through supplementary heaters or through Italian flue radiators. With these fans on the top floor, one set of flues or shafts is saved, for in place of the usual method of bringing a cold-air shaft down from the roof to fans located in the sub-basement and then discharging the air upward through another set of flues of practically the same cross sectional area, the tempered air down shaft supplies directly the branch ducts on the several floors. It is so difficult to get ample flue area in buildings of this character, which have few partitions on the lower floors, that the above method has been resorted to. As already stated the plant was designed by Francis Brothers & Jellett, Inc.

For purposes of convenience in description, the ventilating equipment may be divided into eight sections, six of which comprehend a circulation of air under the action of both plenum and exhaust fans, while the remaining two are solely exhaust systems. The most important section is that for the supply of the main rooms of regular occupation by the hotel guests on the ground and first floors; the second system is that for the supply of the palm garden and the café on the ground floor, of the buffet in the basement and of the laundry in the sub-basement; the third system is for the supply of the ball room; the fourth is for the supply of the kitchen; the fifth for the engine and boiler rooms, and the sixth for the remainder of the sub-basement. The first three sections all receive air from above the building roof, with fans located at the inlets, the ball room having two separate inlets, two separate plenum fans and two separate fresh-air down-discharge flues. In connection with the second section, the unusual arrangement has been made of providing a relay fan at the base of the fresh-air supply flue of this section. This was installed to insure a positive air delivery to the laundry during the season that it would not be necessary to run the seventeenth story fan and is also for use in heating the buffet in case anything should happen to the fan or motor on the top floor. The ball room section is absolutely distinct from the rest of the building and need only be in operation when that room is occupied. The remaining five of the six fresh-air distributing systems are all exhausted through two large fans in the sub-basement, except for the air which passes into the boiler furnaces, into the annular space surrounding the smoke flue, and into the pipe shaft back of the dumbwaiters. Besides this pair of exhaust fans and the pair for the ball room system, there is a small fan for ventilating the main toilet in the basement and six fans in the seventeenth story, three of these for exhausting air from open fireplaces in the guests' chambers and three for exhausting through the local vents of the fixtures in the guests' bath rooms. In tracing through these systems, it should be kept in mind that the first floor is above the main or ground floor.

A plan of the seventeenth floor shows the location of various fan units in that story. The unit for the supply to the main rooms, that is section No. 1, is located in the center of the front part of the building and the fresh-air flue down which the fan discharges is a part of a large central flue rising back of the group of passenger elevators. This shaft is utilized very largely for the discharge of vitiated air from the five sections ventilated by the two large sub-basement fans mentioned, and the fresh-air down discharge is cut off from one end of it by a partition which consists of two thicknesses of 6-in. tile enclosing a 2-in. space. Both flues, it may be stated, are plastered smooth with cement mortar. The air for this system is received from a short fresh-air shaft and a 3x8.5-ft. duct into a tempering chamber in which the fan is located, with the tempering coils on the suction side of the fan. This is an American Blower Company's fan with a blast wheel 7 ft. in diameter and 4 ft. wide, direct-connected to a 25-h.-p. Diehl electric motor designed to operate at 220 r.p.m. The area of the main shaft is based on a velocity of 1,000 to 1,500 ft. per minute. The tempering coils are of the A. B. C. pipe-coil heater construction and present, all told, about 3,600 lin. ft. of surface. The heater sections are 12 rows deep, arranged in three groups, two separately controlled by thermostats in the cold-air entrance, so as to come into action successively, and the other by a warm air thermostat.

Air filters of the cheese-cloth pattern are, of course, provided, located at the cold air inlets in the case of all of the fresh-air fan systems. The cheese-cloth surface is arranged in the usual zig-zag fashion, but the construction of the framework is somewhat unusual, owing to the covering of the frames with sheet iron. The details of the filter construction are shown in the illustrations. The scheme for securing tightness of joint and the method of holding the filter sections in place and for removing them is shown. The filters are required to have an area that will keep the maximum velocity of air through them below 60 ft. per minute.

The air from the fan of system No. 1 is distributed to the private dining and reception rooms on the first floor, to the ladies' dining



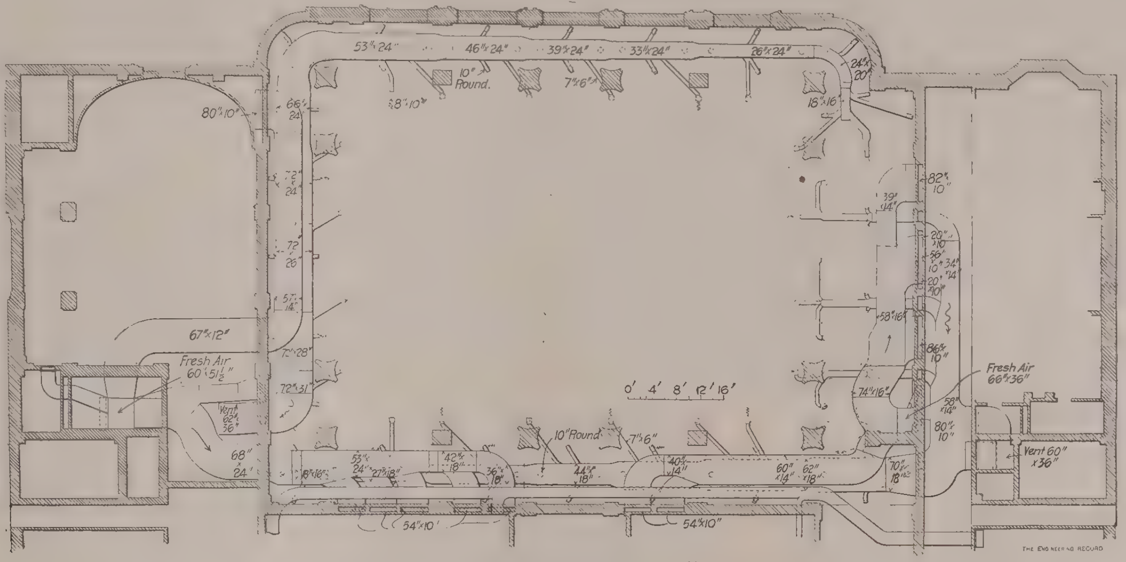
Air Supply and Exhaust Units in the Seventeenth Story; Details of Air Filters.

room and the entrance lobby on the main floor and to the children's dining room, barber shop and adjoining offices on the basement floor. While the air supply, generally speaking, is reheated so as to serve for warming as well as ventilation, the dining rooms on the south side are arranged to be heated entirely by direct radiation and the air supply is merely tempered. For the distribution, the space over the corridors in the basement and first floors are utilized, the main duct in the case of the basement floor supplying branches which drop to fresh-air registers in the basement rooms and rise to fresh-air registers in the main floor rooms. The fresh-air down-shaft is 5 ft. square, and for the diversion of the required amount to the first-story rooms a movable deflector, attached to the bottom of the entrance to the first floor ceiling duct, is provided, pointing against the downward flow of the air. A cross-section of these connections is shown in one of the engravings. For the lobby the air is taken from the system through a box coil having 200 sq. ft. of surface and discharging through one large register in the lobby wall.

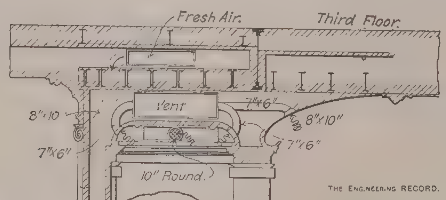
The rooms supplied by this system are in general designed for four changes of air per hour where there is to be no smoking, and for five to six changes where smoking is allowed, with the fresh-air registers in the upper part of the walls, after the fashion of the usual school ventilating system, with velocities through the register openings averaging 400 ft. per minute. The first floor private dining rooms are provided with both top and bottom ventilating registers connected together and controlled by a chain at the lower register so that when one is open the other is closed. In all rooms where there is likely to be smoking, an upward flow of air is arranged for, and the possibility that smoking might often occur in these private dining rooms led to the provision for either upward or downward ventilation.

The ducts for carrying the exhaust air from the rooms are likewise suspended above the corridor ceilings in the basement and second stories and both lead eventually to a fan room at the bottom of the central shaft where the two large fans for the general ventilation are located. These are 7 ft. in diameter and 4 ft. wide and are each direct-driven from a 20-h.p. motor running at 220 r.p.m. Their capacity is designed to exhaust somewhat less air than that introduced into the rooms, in order that a slight plenum may be maintained to prevent inleakage through open doors and the like.

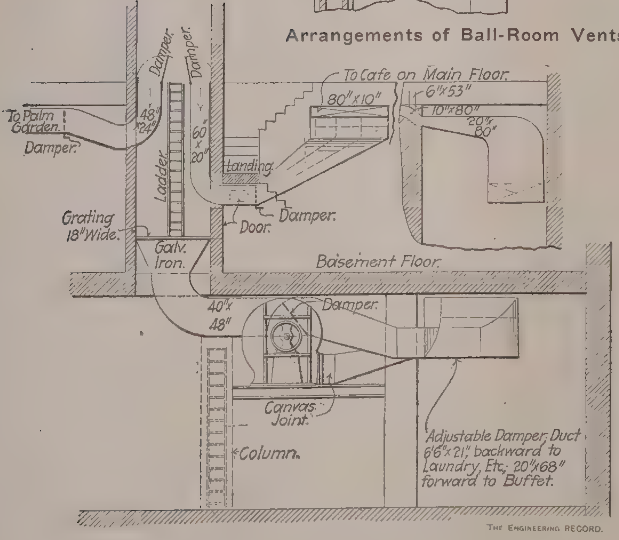
The second system, or that for the palm garden and other rooms mentioned, receives air through the northwest shaft. The apparatus in the seventeenth story contains a tempering heater of 3,600 lin. ft. of pipe coil surface and a 7-ft. blower driven at 220 r.p.m. from a 25-h.p. motor. The connections with this shaft at its base are shown in another of the engravings. The main duct for the palm garden and the gentlemen's café are supplied, as indicated, at the basement story by means of movable dampers, while the supply to the laundry and the buffet takes from the bottom of the shaft. As already explained, the interesting point is the provision at this point of the relay fan. The air passages include a by-pass around the fan, which may, therefore, only be operated when the top-story fan is shut down for any of the reasons enumerated. This relay fan is 4½-ft. in diameter and directly driven by a 5-h.p. mo-



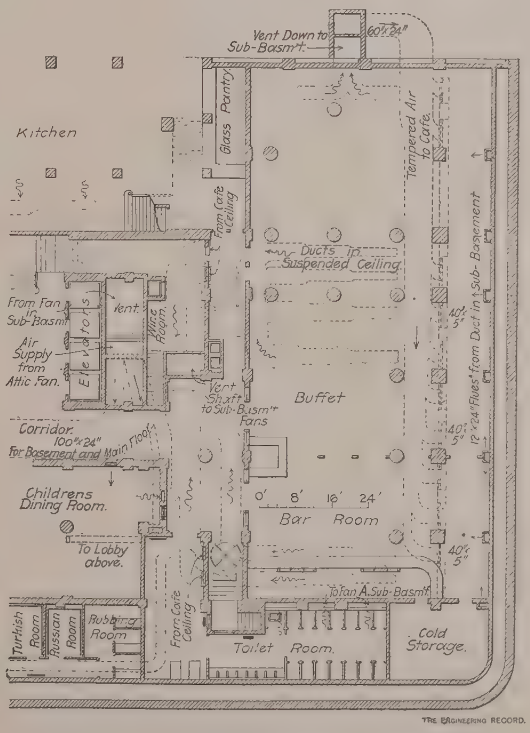
Scheme of Ventilation for the Ball Room.



Arrangements of Ball-Room Vents.



Arrangement of Relay Fan for Laundry and Buffet.



Exhaust Duct System for Buffet and Cafe.

tor; its inlet is controlled by a damper, as indicated. Alongside of the fresh-air shaft of this system, for the greater part of its drop through the building, is a second shaft which is one of the two provided for conducting the vitiated air from the ball room.

In the palm garden the air is discharged mostly through five Italian flue radiators at the outside windows, aggregating 520 sq. ft. in surface. The radiators are 20 in. high and are placed behind casings which have sill registers. There are two other air inlets, at opposite ends of the room near the outside wall, each with a 30x30-in. register about 8 ft. above the floor level. Here upward ventilation is followed and the air admitted at the exposed part of the room passes out of it through the numerous openings of the decorative ceiling work. To collect the vitiated air there are ten transverse ducts above the ceiling leading into a duct which connects into the fan chamber at the bottom of the central shaft.

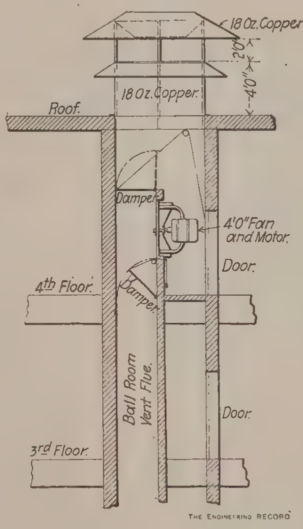
In the case of the café the fresh-air supply duct is run above the ceiling of the buffet supplying eight short upcast flues which deliver into the café through as many Italian flue radiators, aggregating 520 sq. ft. of surface, arranged, like those in the palm garden, underneath the windows. Besides the flue radiators there are also 330 sq. ft. of direct radiation at windows at the front end of the room. The air passes out through ornamental ceiling openings and there are six transverse ducts leading finally to the sub-basement fan room at the central shaft.

The buffet system is quite similar; the air is introduced along the outside wall 6½ ft. above the floor, while it is taken out through the ornamental ceiling where transverse ducts serve to connect it with the central shaft fan chamber. The room is, however, located in the basement, and instead of the Italian flue indirect radiators, supplementary heating surface is provided a short distance beyond the relay fan at the bottom of the northwest shaft.

The ball room, which is about 78x108 ft. in area and 29 ft. high, is also ventilated on the upward system. There is a gallery extending all around the room and underneath this in the three inside walls of the room are the fresh-air registers, all 20 in. high and of varying widths. There are in all 27 registers, 7 ft. above the floor, presenting a net area of opening of about 62 sq. ft. In the fourth wall, that along the rear of the building, is direct radiation enclosed in cast-iron casings at the base of the windows in this wall, but with registers allowing for a circulation of the room air through them. The air supply is tempered and the direct radiation is for heating. The fresh-air supply is calculated for six changes per hour. The outflow of air is accomplished through an elaborate system of ducts leading from 10-in. round and 8x12-in. rectangular openings scattered around the ceiling above the galleries. Altogether there are 114 exhaust outlets in the ceiling, aggregating 44 sq. ft. in net area, which is 29 per cent. less than the area of the supply registers. A typical cross-section through the ceiling construction showing the ventilating passages is given in one of the drawings.

The ball-room system is the third of those enumerated, and is supplied, as stated, through two separate fresh-air shafts dropping from the seventeenth floor. At the head of each of these shafts is a fan chamber, having a tempering coil and a plenum fan operated from a 7½-h.p. motor, these fan-heater units being also supplied by the American Blower Co. Space over the ceiling of the ball room is provided for the run of the various ducts. Each fresh-air flue supplies two branch ducts, each leading to downtakes to the fresh-air registers as shown. The vent ducts are similarly divided, half of the openings connected into one of the vent shafts of the ball-room system and the rest to the second shaft. Each of these rises to a 4-ft. Blackman, furnished by Messrs. Howard & Morse, of New York, each fan driven by a direct-connected 4-h.p. motor. The top of this shaft is protected with a copper hood of special construction.

The kitchen system is supplied with fresh air from two fans mounted on the same shaft and driven at 450 r.p.m. by a 7½-h.p. motor. These fans are located above a rear entrance to the building at the basement and each is 3 ft. in diameter, two fans being chosen owing to the limited head room available above the entrance. The interesting feature is that the heater coils are placed over the Van Kannel doors, taking the air supply from the outside, through specially designed registers. This system supplies the main portion of the kitchen, a small portion of air being delivered to one of the auxiliary departments of the kitchen from the duct system of the laundry. It is designed to change the air every 8 or 10 min. The air is exhausted from the kitchen partly through ducts which lead to the central ventilating shaft and partly through ducts which run from hoods over ranges and steam kitchen boilers to the air space surrounding the smoke flue.



Ball-Room Vent Shaft.

The fifth system, or that for the engine room, is supplied with cold air forced through the usual swivel form of down spouts distributed in both the boiler and engine rooms. The fan is 6 ft. in diameter and runs at 220 r.p.m. from a 10-h.p. motor. It is located adjacent to an air inlet near the side entrance to the hotel, as indicated in the drawings. Altogether there are 24 air discharge openings, aggregating 44 sq. ft. Eight of these are in the boiler room, each 16 in. in diameter, and eight in the engine room, aggregating 20.9 sq. ft., with the remainder in the pump rooms. The sixth system is supplied from a 5-ft. blower driven by a 7½-h.p. motor, located near the engine-room unit and taking from the same inlet. The engine room system is, of course, without any tempering surface, but the sub-basement system, so called, which supplies locker and other rooms, is so equipped. This unit, however, also delivers air to the rear of the pump room and to the refrigerating plant, and the fan is of the double discharge pattern. The second discharge does not, of course, deliver through a heating coil.

The remaining systems, comprising those for ventilation only, include a 40-in. exhauster driven from a 3-h.p. motor, located at the base of the central ventilating shaft and providing for a positive outflow from the main toilet room in the basement. It discharges into the central ventilating shaft. Besides this are the fans in the seventeenth story for the fireplace and local ventilation. There are three 4½-ft. exhausters, each driven by a 7½-h.p. motor, for the fireplace ventilation, and three 3½-ft. exhausters, each driven from a 6-h.p. motor, for the local ventilation system. An extensive system of ducts in the seventeenth story was necessary for connecting together all the flues, and the fans are located in pairs, one for the local vents and one for the fireplace vents, the three groups placed in a central position with respect to the corresponding portions of the building served. Altogether there are 41 flues, 9 in. in diameter, for the local vent system and 24 flues, of 10 to 25 in. diameter, for the fireplace vents.

(To be concluded.)

Assessing the Cost of Water Mains.

One of the problems which occasionally arise outside his special line of work to bother the city engineer is the method of meeting the cost of pavements, sewers, water mains and similar improvements. A large number of different systems of providing funds have been proposed and a number of them have been passed upon judicially. While the courts of final jurisdiction of different states have made various interpretations of the right to levy local assessments for such improvements, the subject is of such importance that decisions like that of the Supreme Court of New Jersey in Doughten vs. City of Camden, 59 Atl. Rep. 16, are of general interest. The question involved was the right of the legislature to authorize the city to place a lien on land fronting on either side of a street to the amount of 75 cents per front foot to meet the expenses of laying water mains. The decision of the court reads as follows:

Long ago it was settled by our court of last resort, as a general proposition, that the cost of a public improvement could be imposed on particularized property only to the extent to which such property was exceptionally benefited. But a distinction was then noticed between improvements which are primarily for the public welfare and only incidentally for the benefit of the landowner, and those of which the converse is true. While with respect to the first class the proposition just stated must be rigidly applied, with respect to the second class the rule is not imperative, and the legislature may charge the actual cost on the private property to which the chief advantage accrues, even though the benefit be not an exact equivalent. Of this latter class are sidewalks and curbs, the gutters of unpaved streets, and the house connections of sewers, which are deemed appendages to the adjoining land.

On behalf of the city it is urged that water pipes laid in urban streets for the common use of the neighboring inhabitants have the characteristics of this second class. This position seems well supported, at least with regard to those landowners who avail themselves of the conveniences provided. The principal object of these appliances is to furnish water for domestic and business purposes on the adjacent private property, and the value of such a provision is ordinarily greater than that which an improved sidewalk would afford to the property. On the other hand, the essentially public use of a water supply is but small in comparison with the private utility, and is less than the public use of an improved sidewalk. Hence, if sidewalks and their appurtenances are legally regarded as primarily for private benefit and only incidentally for public welfare, there is no reason why water pipes laid in the streets of our municipalities should not be viewed in the same light. Indeed, this idea of paramount private utility is emphasized in the very statute now under consideration, the title of which designates 'citizens' and 'inhabitants' as the beneficiaries of the legislative scheme. Consequently the principle which justifies the legislature in charging against adjoining property the expense of constructing sidewalks will warrant a similar imposition for the laying of water pipes.

There are, however, in this state two cases which may be thought to have a contrary bearing (Vreeland vs. Jersey City, 43 N. J. Law, 135, Id. 638; Culver v. Jersey City, 45 N. J. Law, 256), where it was held that a fixed annual charge levied upon land bordering on streets through which water pipes were laid, but not using any water, was unconstitutional as a general tax because not graduated by the value of the land, and as a special assessment because not graduated by the benefit conferred. But those cases differ from that in hand, first, because the legislature had not attempted to confer on Jersey City authority to charge against the land the expense of laying water pipes in front of it; and, second, because the city had not fixed the charge to meet such expense. Conditions corresponding to these are necessary to justify such an imposition as that now under consideration.

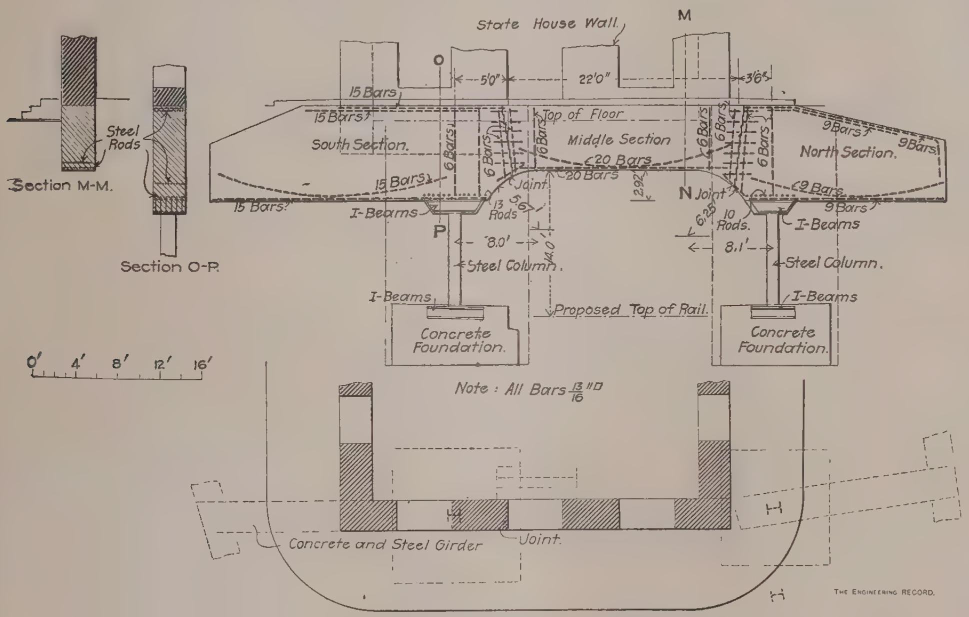
There is another view that may be taken, leading to the same result. As already noticed, the statute enabling the city to furnish a water supply directed that, for the expense of laying pipes through the streets, 75 cents per foot should be paid by the owners of adjoining land, and should be a lien on the land until payment. Owners who accepted the benefits of the water supply thus provided should be deemed to have assented to the burdens accompanying it, and thus, even though this assessment could not be imposed on those not receiving the water, it might be legally levied on the property for which the owners did appropriate the supply. The testimony shows that in all of the lots now in question the city water had been taken by the owners, not only through the pipes for which this charge is made, but also through those for which these have been substituted.

LIFTING MAGNETS have never been the cause of an accident, so far as the knowledge of the Electric Controller & Supply Co., Cleveland, goes.

A Large Steel-Concrete Underpinning Girder.

The curved double-track East Boston tunnel of the Boston Transit Commission has a concrete roof supported on steel beams, girders and columns, and, between Devonshire and Washington Sts., passes under the old State House in a direction nearly perpendicular to the end wall. The tunnel is so shallow that there is no clearance between its roof and the footings of the State House walls, and special underpinning was necessary to support the latter without in any way changing, injuring or obstructing the interior of the building or the adjacent street. This has been accomplished very successfully by building in sections under the wall and on its center line very heavy reinforced concrete girders of the full thickness of the wall, which are supported on steel columns and afford a clear span of 27½ ft. over the tracks.

The girder consists of three sections with a combined length of 67½ ft. The two side sections are supported at the ends on the side walls of the tunnel (not shown here in elevation) and intermediately upon steel columns, which they overhang, to form short cantilever arms supporting an independent span of 22 ft. across the tracks. The side spans act as anchor arms for the cantilevers and span the entrance stairways of the Devonshire St. station. The whole construction resembles a three-span cantilever bridge and was made in successive operations, the anchor spans and cantilevers first and the center span afterward. The State House wall was supported on needle-beams while the girders were being built close to their footings, which were somewhat cut away to clear them and were afterward lowered to rest entirely upon them.



Plan at East End of Old State House

Reinforced Concrete Girder under Old State House.

The columns are capped with grillages of six 15-in. I-beams about 5 ft. long, filled solid with concrete and placed in the planes of the girders, forming corbel supports for them. One side span is 9 ft. deep over all and 23½ and 5 ft. long from the center of the column to the ends of the anchor and cantilever arms, respectively. The outlines and the positions and numbers of the reinforcement bars in all girders are indicated in the elevation. The other side girder has anchor and cantilever arms of 16½ and 3½ ft. long, respectively, and is 9 ft. in maximum depth. All of the reinforcement bars are of corrugated steel, Johnson system, and are uniformly 13/16 in. square. Those in the lower edges are placed in two tiers, the upper tier being segments of a long-radius arc tangent to the lower bars in the middle, with the ends inclined upward to resist shearing stresses. Over each corbel there is an extra tier of transverse rods to reinforce the concrete for the concentrated bearing load, which amounts to a maximum of 750,000 lb. on the column, and is limited to 400 lb. per square inch on the upper face of the corbel.

The cantilever ends of the girders are offset with 1-in. horizontal steps and 12-in. rise, inclined slightly from the vertical so that the lower ends of the cantilevers project farther from the column center than the upper ends, thus making the center section of the girder, which is stepped to correspond, act like an arch key. The center girder is 6 ft. deep in the middle and 22 ft. long on the center line. The girders are not continuous concrete structures, but are bonded together through the offset joints by horizontal steel rods 3 ft. long, which equally engage the ends of both girders and prevent any displacement.

The girders have a uniform thickness of 3 ft., corresponding exactly to that of the wall above, which, disregarding the door and window openings, has an estimated weight of about 10 tons per linear foot. A peculiarity of the construction was occasioned by the necessity of placing one of the cantilever girders at an angle with the other two girders, as is shown in the plan, where the two are represented as intersecting with a miter joint just outside the corner of the State House. The girders are made of concrete mixed in the proportion of 570 lb. Vulcanite Portland cement, 5 cu. ft. fine crushed stone, and 11 cu. ft. coarse crushed stone, with no fragment larger than 2½ in.

The work was designed and constructed under the supervision of Mr. H. A. Carson, chief engineer of the Boston Transit Commission, and was built by Woodbury & Leighton, contractors, and Mr. J. R. Worcester, consulting engineer.

Sawing Stone by Wire.

Stone sawing by wire is done successfully in France, according to a paper by Mr. E. Bourdon in the "Bulletin" of the Society for the Encouragement of National Industry. A complete plant comprises an endless wire passing round a series of pulleys, one of which is a driving-pulley. The necessary tension is obtained by a straining trolley working on an incline plane, and between the driving shaft and this trolley is situated the saw frame, which carries the guide-pulleys for the wire saw. This wire, which is driven at a given speed, is caused to press lightly on the stone, and the cutting is done by sand mixed with water, which is conveyed into the saw-cut as the work proceeds. Though the mode of operation appears simple, it entails various difficulties in practical application. Three twisted steel wires are used, each wire having a diameter of 0.098 in. The strands must be twisted fairly tight and should make one turn in 1.18 in. The wire may be driven in the workshop at a speed of 23 ft. per second, but in quarries or adits the speed should not exceed 13 ft. per second. The force exerted by the wire to produce the cut must be uniform and must be capable of being readily varied; moreover, it must be proportionate to the length of the cut.

THE ONTARIO POWER PLANT on the Canadian side of Niagara Falls, which was recently described in this paper, is to be increased by the addition of a fourth Westinghouse generator rated at 10,000 h.-p. at 85 per cent. power factor.

The Substructure of the Cambridge Bridge, Boston.

The bridge over the Charles River between Boston and Cambridge, at the site of the old West Boston bridge, will be an unusually attractive structure, carrying an important city street. A special effort has been made to design a dignified structure of a monumental character in harmony with its surroundings. Notable European bridges were visited and many preliminary studies were made before designs were obtained for a structure satisfactory to the Commission and its technical staff, and also to the United States War Department. In July, 1900, work was commenced on the substructure, and it was substantially completed. The erection of the superstructure commenced last summer.

The bridge will be 1,767½ ft. long and 105 ft. wide between railings, and will carry four lines of car tracks, two wide roadways and two sidewalks at the same level, although the two center tracks will be used by the elevated railroad tracks. There will be eleven steel arches of from 101 to 188½ ft. clear span, each with twelve plate-girder ribs of 8.43 to 26.67 ft. rise The bridge will be cambered to a continuous curve from end to end, giving a total height above low water at the center, of 48½ ft. and a clearance, above high water, of 26 ft. The spans are arranged with the short ones at the ends and the longest in the center, so that the increasing rise of the arches corresponds to the camber heights and allows the skewbacks to be at a uniform level. An important feature of the design is the massive character of the piers, which are made much heavier than is required by theoretical considerations in order to give dignity to the structure. The two piers for the wide center span have foundations 201 ft. long and 67 ft. wide. The ends are finished with large bas-reliefs of the coat of arms of the city of Boston, carved in large granite stones projecting from the solid masonry. Each of these piers is surmounted by an ornamental stone tower at each end rising 40 feet above the roadway, and smaller towers are placed on each abutment. The edges of the roadway will be covered with ornamental fascia girders surmounted by a massive hand rail.

The foundations of all piers and of both abutments are made with longitudinal and transverse rows of spruce piles from Nova Scotia and New Brunswick. They are from 25 to 50 ft. long and about 3 ft. apart on centers. Their upper ends penetrate the bases of the concrete foundations, which rise to a height of 5 ft. below low water. On these foundations are built the rock-faced granite piers with concrete backing. The pier masonry is made with quarry-faced granite stones, some of which weigh as much as 16 tons each. The cut stone skewbacks weigh 8 tons each and are set in ½-in. cement mortar beds. The abutments and wing walls are of similar massive construction, and the total estimated cost of the substructure is about $1,000,000.

The contracts for the substructure were awarded in several different parts, the first of which was let in June, 1900, and work was commenced in July by the removal of the old West Boston bridge and the construction of a pile-trestle bridge with a drawn span to accommodate highway traffic and navigation during the building of the new bridge. The pier sites were excavated to depths of from 18 to 24 ft. below low water by dipper dredges, and most of the spoil was loaded on scows and dumped at sea. Some of it, however, was reserved to use for filling around the completed piers. The piles for each foundation were driven in two equal sets by a special 10,000-pound steam hammer, described in The Engineering Record of July 6, 1901. The first set was composed of alternate piles staggered in adjacent rows, and was driven to hard bottom and cut off at from elevation —12 to —22 by a 42-in. circular saw mounted in the usual way on a vertical shaft movable in pile-driver leads and operated by a 50-h.p. hoisting engine. The second set of piles was driven in the spaces between the piles of the first set, and were cut off at an elevation 2 ft. higher than the others. This arrangement was provided chiefly as a matter of convenience in driving and cutting.

Although the piles would often sink from 10 to 20 ft. in the soft mud under the weight of the steam hammer without any driving, they soon became very tightly fixed in position, so that it was almost impossible to withdraw even those which had been driven to a depth of only 8 ft. for falsework purposes. Many times these piles could not be started by a 12-part tackle operated by a 10x12-in. engine, and the only way which was found successful was to attach them securely at low tide to a large scow, which would either pull them or be itself submerged as the tide rose.

Each foundation was enclosed by a cofferdam made with walls of sheet piles from 36 to 42 ft. long. Each pile was made from a 6x10-in. or larger timber with 1½-in. tongue and groove pieces spiked to the edges. After the foundation piles were driven and cut off, double rows of falsework piles were driven around each pier, and on them a platform was built from which the cofferdam sheeting was driven. These sheet piles were driven with an ordinary steam hammer between inner and outer lines of 12x12-in. walings bolted just above water level to ordinary bearing piles. Two sheet piles were driven about 10 ft. apart, and then the space between them was filled with sheet piles carefully set in position at low water, the last pile being cut to fit and made wedge-shape to insure tight joints. In this way the long walls of the cofferdam were built in 10-ft. sections and were closed successfully, so that little difficulty was experienced from leaking.

Horizontal rangers and cross braces were used to resist the outward pressure, and although the theoretical position for the heaviest line of them is one-third the distance from the bottom to the top of the cofferdam, it was observed that the tops of the dams always appeared weakest, and the rangers were gradually moved upward until they were finally placed 3 ft. above the theoretical heights. This was thought to be due to the stiffness of the sheet piles and the firm support which they had in the hard bottom. A curious fact observed in pumping out the cofferdams was that while a 14-in. centrifugal pump with a maximum lift of 21 ft. would easily keep the cofferdams dry during a falling tide, it was almost utterly unable to do so at the same stage of a rising tide. No explanation was discovered for this fact.

About 75,000 cu. yd. of concrete were used in the substructure, and a very complete and satisfactory plant was installed for storing and handling the materials and for mixing and delivering the concrete. This plant had a large capacity and was equipped with standard machinery, which has endured continuous service here for over two years, and most of it is in good condition to be installed on other work. The arrangement of the plant was carefully studied to secure simplicity, economy and convenience, and liberal use was made of labor-saving appliances and of steam power, so that a large and continuous output was secured with minimum labor requirements. The storage and mixing plant was built on a temporary pile foundation located just north of the axis of the bridge between piers 8 and 9, and was connected with the parallel temporary highway bridge by a pile trestle bridge about 40 ft. wide and 250 ft. long, which also served as an unloading and storage platform for the machinery and supplies. The concrete plant was contained in a timber tower built to a height of about 50 ft. above the water and equipped with storage bins arranged so that the materials were classified and delivered for measurement and mixing by gravity.

Sand and gravel dredged from the Shirley channel was brought in 300-yd. scows and dumped in the river adjacent to the concrete pier, where the water was about 10 ft. deep. It was supplied by the Eastern Dredging Company, who installed a special boom derrick to operate an orange-peel dredge with a 1¼-yd. bucket which delivered the gravel from the submerged pile to a series of three elevated screens inclined at an angle of 45 degrees with the horizontal. The first screen was made with 2x½-in. steel bars 3 in. apart set edgeways. This delivered cobblestones up to sizes of about 3 cu. ft. to a storage bin, from which they were fed to two Farrell foundry rock crushers. Screens Nos. 2 and 3 had respectively 2-in. and ¼-in. meshes, and delivered the gravel directly to hopper-bottom storage bins. The sand passed through these screens and was delivered through a chute to the main storage bin. In order to prevent the lower screens from clogging, a constant stream of water was played on them, which was pumped from the bay by a 4x6-in. Worthington pump to an elevated tank which provided a 15-ft. head.

The sand in the storage bin was thus always very wet, and was delivered through a chute to the boot of a vertical elevator with perforated 4x12x5-in. steel buckets attached to link-belt chains. These buckets delivered it to the elevated storage bin, from which it was discharged by gravity to the measuring hopper as required for the concrete mixer. The gravel and the broken stone were similarly hoisted in 8x8x12-in. steel buckets to the elevated bins, from which they were also delivered to the measuring hopper. The link belts to which the sand elevator buckets were attached were each driven by two smooth traction wheels, and difficulty was occasioned by the tendency of one link belt to travel faster than the other, thus breaking the bucket bars. Diagonal bars were inserted between the bucket bars and were partially successful in preventing this. In the gravel elevator, the link belts were driven by sprocket wheels and gave great satisfaction. The hopper bottoms of the sand, gravel and stone bins were closed by steel gates operated by racks and pinions commanded by hand wheels.

Cement was delivered by wagons from the temporary highway bridge to a shed at the end of the connecting bridge, where about 4,000 barrels were constantly stored. These were delivered to the concrete house at a rate of about one in 40 seconds by a horizontal link-belt chain conveyor 220 ft. long, with cradles to receive the barrels. About 600 barrels of cement were thus handled in 9 hours. Their heads were removed as soon as they were received at the concrete house, and at a given signal from the mixing foreman, 3 barrels were emptied into the elevator boot, and in 5 seconds were discharged into either of the two measuring hoppers, which were arranged and operated as described in The Engineering Record of July 6, 1901.

The sand and gravel were then added, and as soon as the empty mixer was in position, it was charged by the operation of a double gate which opened one measuring hopper while it closed the other. This gate was a large horizontal steel plate with a 20x20-in. hole on one side and a blank on the opposite side, so that one hopper was always closed when the other was open. The 5-ft. cubical mixer was revolved from 8 to 15 times, and then discharged its contents into a 4-ft. cubical wooden bucket made, as shown in the accompanying sketch, with vertical angle-iron corner pieces and double flat bottom valves, which are held in place by vertical links engaging the ends of horizontal angle bars which project beyond their edges. The upper ends of these links are pivoted to the lower ends of vertical rods sliding through bearings on the sides of the buckets. These rods are connected to pairs of side chains which allow for about 3 in. vertical movement. The upper ends of the rods are suspended from the hoisting tackle of the derrick, and when the bucket is raised, the weight is carried through the rods and the lower links, holding the flaps closed. In order to empty the bucket, the links are disengaged from the ends of the angle bars and the weight of the bucket is transferred to the side chains, the flaps being released, revolve downward and allow the contents of the buckets to be discharged. The buckets are seated on special trucks provided with cradles, which engage and guide the flaps so as to close them automatically as the buckets are lowered upon them, after which the links are engaged with the angle bars and the bucket is ready to receive its charge from the concrete mixer.

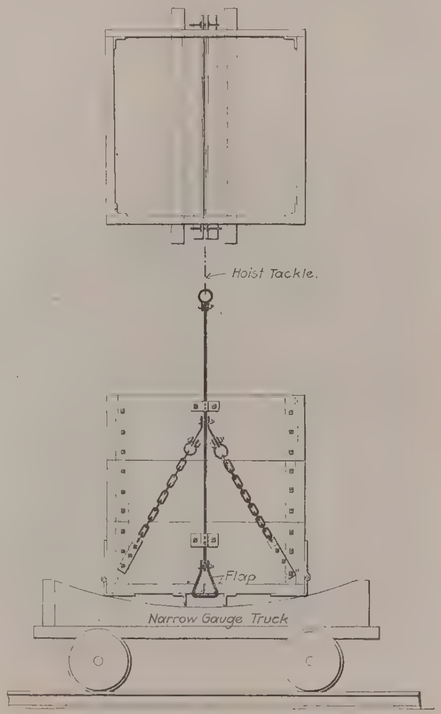
A 3-ft. gauge, concrete and material track in the axis of the bridge was carried on pile trestles from abutment to abutment. It was provided with an endless cable by which the concrete and stone cars were rapidly delivered to the piers and returned at a speed of about 1,000 ft. per minute. The ⅝-in. steel cable had a total length of about 2,000 ft. and took three turns around the 3-ft. driving sheave of a 40-h.p. engine in the concrete house. From the vertical driving sheave the cable was deflected around horizontal sheaves and thence carried by idler pulleys along the center of the track, running around the horizontal sheaves at both ends. Two concrete cars were usually taken at once and were coupled together to form a link in the endless chain, thus avoiding the loss of time which would have been occasioned by sending single cars to so great a distance.

The continuity of the track was sometimes interrupted by the opening of the draw span, which it was necessary to maintain in it. When this was done, the cable was simply unhooked from the car and the upper part overhauled until the lower part dropped to the bottom of the river. After the boat had passed, the end of the cable was pulled up by the engine and re attached to the car, the whole operation involving a delay of about 15 minutes. The cars were sent from the mixer to the piers and back with an attendant and were operated with great precision by one man at the engine track, who had marks on the cable, and was also in a position to see the full length of the line and receive signals, if necessary, from any part of it.

The 1 : 2 : 4 concrete was made with Lehigh Portland cement and gravel or broken stone up to a diameter of 3 in. It was mixed with salt water admitted in measured quantities from an elevated tank. The capacity of the mixing plant was only limited by the speed with which the concrete could be transported and put in place. The average amount used daily was about 156 cu. yd. and the maximum amount was 440 cu. yd. In the Boston abutment, which was 1,400 ft. from the mixer, an average amount of 220 cu. yd. was placed in each 10-hr. day.

At each pier the concrete buckets were unloaded from the cable cars by two derricks with 85-ft. 8-ton booms. Up to a height of 6 ft. below low water level, the concrete was deposited under water by means of a tremie described in the previous article. This consisted of a vertical steel tube about 18 ft. long which was made in 4-ft. flange-connected sections and was tapered from a diameter of 20 in. at the top to 24 in. at the bottom to prevent possibility of clogging. It was suspended by two differential hoists from a trolley, which was traversed back and forth at a speed of 5 ft. per minute by a steam-power worm gear on a transverse timber bridge. This bridge in turn traveled from end to end of the pier on a single longitudinal rail laid on the upper edge of each long side of the cofferdam.

The tube was adjusted so that the lower end was always just above the surface of the concrete, and it was filled through a funnel from a 2-yd. storage hopper, which was closed by a 16x16-in. horizontal steel gate operated by a rack and pinion. After the tube had traversed the width of the pier, the bridge was moved forward by lines on capstan heads of the hoisting engine which operated the derricks. During working hours the tube was kept constantly filled with concrete, which would not escape unless the bottom of the tube was lifted or moved laterally, and which sealed it so thoroughly that little or no water could enter. The tube was left filled during the noon hour, but was emptied at night. After the submerged concrete was deposited, the cofferdams were pumped dry and the remainder of the foundation concrete up to elevation 4½ was placed and rammed in the usual way. The surface of the submerged concrete was found to be smooth and uniform and was exceedingly hard, so that it was difficult to dress it with picks, as was done to improve the bond between it and the upper portion.



Concrete Bucket and Truck.

The concrete extends some distance below the tops of the piles and has an average thickness of about 25 ft. After the completion of the foundations, no attempt was made to pull the sheet piles, but they were sawed off at elevation 6 by the circular saw, which was fitted with a stop to prevent it from cutting into the concrete. The stone masonry was built in the usual way, except that it was carried up to the full height at the ends of the piers, while an opening was left through the center for the material track, the side walls being racked off and not completed until the rest of the work was finished. The piers were completed successively from both abutments to the middle of the bridge, so that the material track was always in service for all unfinished work.

Steam for all power purposes was furnished by a battery of two 75-h.p. boilers. The stone crushers were driven by a double 10x16-in. engine, and the concrete mixer was driven by a 10x12-in. Erie engine, which also operated the sand, stone and cement elevators by sprocket chains. An 8x12-in. Lambert engine operated the cable in the material track. The derricks were each equipped with a 7x10-in. Lidgerwood hoisting engine with swinging device. The cofferdams were drained by two centrifugal pumps, which had a combined capacity of 25,000 gallons per minute. The principal quantities involved in the substructure contracts included about 75,000 cu. yd. of concrete, 18,000 yd. of cut granite masonry, 25,000 piles and 130,000 yd. of dredged material. These materials made 270 scow loads of spoil, 30 schooner loads of piles, 2 ship loads of hard pine, 40 cargoes of stone, 2,500 wagon loads of sand and gravel and 2,500 wagon loads of cement.

The designs of the bridge were prepared by a special commission, which was composed of the mayors of Boston and Cambridge, and Dr. E. D. Leavitt, with Mr. William Jackson, chief engineer; Mr. Edmund M. Wheelwright, architect; Mr. John E. Cheney, first assistant engineer; Mr. M. Woodward and Mr. E. W. Harkness, assistant engineers. The contracts for the substructure was awarded to Messrs. Holbrook, Cabot & Daly, who, with their successors, Messrs. Holbrook, Cabot & Rollins, have now substantially completed the work, all of which was done under the superintendence of Mr. J. W. Rollins, Jr., of the firm.

The Effect of Boiler Conditions on Efficiency.

The condition of a boiler as affecting its efficiency of operation was emphasized by Mr. J. E. Bell in a paper before the Ohio Society of Mechanical, Electrical and Steam Engineers. One boiler referred to, for example, had not been cleaned for several months. Internally it was in fairly good condition, a slight coating of scale appearing in the tubes; on the outside of the tubes, however, every portion offering a lodgment for dust contained all that it could hold. The evaporation obtained per pound of dry buckwheat coal was 8.04 lb. from and at 212° Fahr. A few days later, after the boiler had been cleaned, another test showed an evaporation of 10.3 lb. from and at 212°. The thickness of the fire, which to a certain extent controls the amount of air passing into the furnace but depends on the quality of the coal, was also referred to. In two tests, alike in all particulars except as to thickness of fire, in the case of a pumping plant, a duty of only 93,000,000 ft.-lb. could be obtained when the fire was 8 to 9 in. thick, while a duty of 143,000,000 ft.-lb. was realized with 14 to 15 in. of fire, the one in charge at the first trial being unaware that the latter depth of fire was preferable with the high-grade semi-bituminous coal employed.

The Three Diesel Engines at the Tyrolean Alps at the Louisiana Purchase Exposition were each of 225-h.p. and ran at about two-thirds of their rated capacity. Daily records were kept of the fuel used and the work done. The work was measured at the switchboard, no allowance being made for loss of energy in the engine, air pump and generator. Indiana oil was used for fuel and cost 3 cents a gallon in car-tank lots. According to Prof. C. M. Woodward, the records worked out to 2.15 mills per horse-power-hour for fuel.

Combined Chemical and Biological Sewage Disposal Works at Chichester, England.

The sewage disposal works of Chichester, Eng., which were originally built as a precipitation plant using alumina ferric and lime, have been considerably enlarged by increasing the tank capacity and by adding a continuous filter for treating the dry-weather flow, and contact beds for treating the storm water. The original works embraced three precipitation tanks with a combined capacity of 126,000 gal., a building containing direct-acting ram pumps for compressing the sludge, and about six acres of irrigation area over which the tank effluent was distributed; the effluent finally passing into the harbor, at the ebb of the tide, from a storage tank. The scheme was designed to remove only the suspended solids, reliance being placed on the tidal currents in the harbor to sufficiently dilute the effluent and to carry it far enough out to sea to prevent a nuisance arising from it. The anticipated results were not obtained, however, and the alteration of the disposal works was made to remedy the unsatisfactory conditions. The changes carried out were recently described by Mr. James Saunders in a paper published by the Institution of Civil Engineers.

The normal dry-weather flow of sewage passing through the works is about 384,000 gal. a day, but, owing to storm-water flow and an excessive leakage of ground water into the system during certain portions of the year, the flow is more than 2,400,000 gal. per day for several consecutive weeks. The sewage is a mixture of domestic wastes and trade refuse, considerable quantities of brewery waste, and the by-products from a tan yard being discharged into the sewer without preliminary treatment. In designing the alterations adherence was made to the chemical precipitation system. The nature of the sewage to be treated and the extreme variations in flow were considered to obviate the substitution of the septic tank treatment, as no storm-water overflows were permitted and the entire flow had to pass through the works. The effluent from the precipitation tanks, up to three times the normal dry-weather flow, is treated on a continuous filter, and the remainder of the effluent above that quantity is treated on contact beds.

The capacity of the precipitation tanks has been increased to 507,600 gal. by the addition of four tanks. These are subdivided and provided with outlets which intercept as much as possible the matter floating on the surface. Valves are so arranged that the sludge can be drawn off without pumping out the tanks, but the top water is occasionally run off to prevent deposits on the walls of the flocculent materials on the surface. With the normal dry-weather flow of 384,000 gal., the sewage takes about 32 hours to pass through the works, and with the greatest flow recorded the day's sewage would require about 4 hours to pass through the tanks. The tanks, and the carriers to the pump well, to the contact beds, and to the tidal storage tank, are all of concrete.

The original direct-acting sludge-pressing plant has been converted into a pneumatic pressing plant. The old direct-acting sludge-forcing rams were fitted with air cylinders, which discharge into a steel receiver. Two steel-plate forcing rams are used either to lift the liquid sludge into overhead sludge vats, from which it flows to the sludge presses, or to force it directly to the presses, of which there are three. The engines are not capable of maintaining an air pressure greater than 65 lb. per square inch, but this has ben found sufficient to produce a good firm cake within a reasonable period.

An automatic recording gauge which measures the flow is placed in the main sewer near its entrance to the tank. For diverting the flow of the tank effluent to different parts of the works, a system of weirs and V-shaped notches is provided. A combined weir and rectangular notch is placed in the carrier leading to the contact beds. The height of the weir is such that there must be three times the ordinary dry-weather flow of tank effluent running in the carrier before any of it passes over the weir to the contact beds. The height of the notch is calculated to be such that only the quantity of effluent that can be purified on the contact beds can pass it. A second weir with a height equal to the height of the combined weir and notch is placed in the carrier a short distance above them. When a greater quantity of effluent is flowing through the carrier than can be pumped on the continuous filter or can pass through the notch to the contact beds, the excess overflows this upper weir and is dealt with on land reserved for the purpose. Other gauging weirs are so placed that, together with those just described, the quantity of tank effluent flowing to any part of the works can be easily ascertained.

The effluent flows from the tanks to the pump well, contact beds and irrigation area by gravity. From the pump well it is elevated to the continuous filter, from which it flows to the tidal storage tank. The effluent from the contact beds also flows by gravity to the storage tank, but can be turned into the pump well.

Concrete-Steel Framework of the Screen House, Ontario Power Co.

The pump well has a capacity of 12,000 gal., and is built entirely of concrete with a flat concrete covering. Four electrically-driven centrifugal pumps are placed in a building adjoining the pump well and elevate the effluent from it to the continuous filter. The current is provided by a single-acting steam engine driving a generator with a capacity of 70 amperes at from 120 to 160 volts. An oil engine driving a similar generator is also installed as a reserve. The surplus current generated by the dynamo charges a 65-cell storage battery, with a capacity of 500-ampere-hours and a maximum discharging rate of 80 amperes. The pumps are 3, 4, 5 and 6 in., and have a combined capacity under ordinary conditions of operation of about 2,730 gal. a minute. The motors, which are directly coupled to them, are designed to withstand heavy overloads, and are capable of exerting an overload torque 2½ times the normal full-load running torque. The pumps are placed below the level of the water in the pump well, so they can be readily started without priming. The 12-in. main from the pump houses to the filter has a static head on it of 17 ft. at the pump-house end.

The continuous filter is in the form of a circle, 198 ft. in diameter at the bottom of the filtrant, and 204 ft. in diameter at its top. It is enclosed in earth embankments and has 4-in. concrete lining and floor, with underdrains built in the floor. The filtering material is of crushed gravel, free from dirt. The bottom 6 in. is composed of particles which are retained by a screen of ½-in. mesh and passed by a screen of 1-in. mesh. The second layer has an average depth of 3 ft. 9 in., and is composed of particles which are retained by a screen of 3/16-in. mesh. The top layer is 1 ft. thick, and is made up of material retained on a screen with 1/16-in. mesh, and passed by a screen with ⅛-in. mesh.

The tank effluent is pumped to a measuring chamber on one edge of the filter, and is automatically discharged into a revolving spreader which distributes it over the bed. This spreader has a length of 200 ft. and is supported at its center in the center of the bed, and at either end by a ball-bearing wheel, which travels on a rail track laid on the top of the circular filter wall. The motive power for revolving the spreader is obtained from the head of water accumulated in the measuring chamber, which acts through a turbine fixed in the base of the central supporting column. The head of water necessary to turn the spreader is 6 ft., and when 3,600 gal. have been pumped to the measuring chamber, it is automatically discharged on the filter through the turbine, causing the revolution of the spreader.

The center column is about 40 ft. high and is stayed at the apex by six ½-in. steel-wire guys, which can be adjusted to meet variations in temperature. This column and the turbine are of cast iron, but both arms of the spreader are steel-framed cantilevers, longitudinally braced for wind stresses, and so assembled that any part of the structure can be tightened up when required. The trough, which is carried by the cantilevers, is built of ⅛-in. plates, riveted together, and pierced by holes of varying size, so as to distribute the same quantity of water per square yard over all the surface. The revolving portion of the spreader is mounted on ball bearings, and the structure is so well balanced there is little or no pressure on the track under the wheels on the ends. In actual working very little pressure is required to start it on a revolution, but some difficulty was encountered in overcoming wind pressure, which had a tendency to bring the structure to a standstill at right angles to the direction of the wind. Two sails, erected somewhat on the principle of the sails of a wind-mill, have proved successful in helping the spreader past the point of greatest resistance.

The spreader makes about two revolutions each time the measuring chamber is discharged, and when actually working distributes at the rate of about 0.52 gal. per square yard. The time elapsing between the periods of working depends, however, on the amount of sewage passing through the works. The rate of discharge of the effluent on the filter is 386 gal. per square yard per day when the maximum amount of sewage, 1,350,000 gal. per day, is flowing. With the normal dry-weather flow the discharge falls to 128 gal. per square yard per day. In working it has been necessary to rake over the upper portion of the filter occasionally, but otherwise the tank effluent readily percolates through it when the full quantity of effluent has been pumped on it for some time.

The four contact beds that have been provided for treating the storm and ground water passing through the works are each 127 ft. in length, 51 ft. wide, and 2 ft. deep. They are lined with 4 in. of concrete and filled with screened gravel which passed a screen of ¾-in. mesh, but was retained on a screen of ¼-in mesh. Automatic valves, placed in a regulating chamber at the common central point, supply and discharge the contents of the beds, the whole working in a cycle.

The storage tank used for holding the effluent until the ebb of the tide now has a capacity of about 600,000 gal. It is lined with concrete, which was not faced. A valve chamber is placed at the outlet, in which a recording cylinder registers the opening and closing of the valve.

The total cost of the works is about $60,000. The cost of construction per square yard of various parts of the works, including all charges, was: The precipitation tanks, $7.47; continuous filter, including distributing gear, per square yard of effective filtering area, $4.30; storm-water contact beds, $2.99; storage tank, $1.72. The gravel in the contact beds and filter was obtained from the bottom of the harbor near the works.

The Concrete-Steel Headworks of the Ontario Power Company, Niagara Falls.

The adoption of concrete-steel construction for the headworks of the Ontario Power Co. of Niagara Falls, on the Canadian side of the Niagara River, is a conspicuous instance of the application of this material. In a series of articles on the general features of this development of Niagara power, recently printed in this journal, mention was made of the concrete-steel structures for controlling the flow of water to the pipe lines. They comprise an intake 600 ft. long, a screen house 320 ft. long, and the head block, the last being a mass of reinforced concrete for the entrance gates to the three pipe lines of the ultimate development.

A general plan of the headworks of the Ontario power development was given on page 421 of the issue of Oct. 8. The intake admits water from the river into a so-called outer forebay, from which in turn it passes through screens, housed in the screen house, where a traveling crane is to be provided for handling the screens, and from the screen house into the inner forebay which leads to the head block and thence to the pipe lines. The intake is designed to intercept water flowing along the bed of the river for a distance of some 440 ft. from the shore line outward, and to divert surface currents toward the center of the stream so as to dispose of in that way the ice and debris floating in the intercepted current. The screen house is designed to catch sand and other heavy particles carried along the bottom of the outer forebay, in addition to screening such material as succeeds in reaching the outer forebay through the intake.

Head Block, Showing Forms for Water Entrances to Pipe Lines.

The intake structure, not yet built, is to have a total length of 600 ft., 596 of which lie across the waterway, the intake itself extending outward from the shore at an angle of about 135 deg. with the direction of river flow. It will consist essentially of a pier-supported submerged curtain wall stopped 6 ft. short of the bottom of the excavated approach to the intake, and leaving the wall submerged at low water about 5 ft. The supporting piers will be 4 ft. thick and spaced at distances of 24 ft., center to center, and the curtain wall will be continuous with a horizontal deck forming the operating floor for the intake gates. The piers themselves will be monolithic concrete, but will be continuous, so far as bonding is concerned, with the reinforced deck and curtain. Each opening through the piers will have a total span of 20 ft., and in order to avoid the use of a single gate for that width, a supplementary pier is to be built midway between the main piers to assist the curtain in carrying the thrust upon these gates when they are in their lowered position. This pier will be built independently of the rest of the structure and will be but 12 in. wide.

The screen house is about 320 ft. long and 31 ft. 8 in. wide at the water line. It is carried on columns along the inlet side and on piers along the outlet side, the piers providing for the steel racks or screens. The piers and columns are spaced 20 ft. apart on centers. The columns carry a curtain wall, serving, like that of the intake, for diverting debris and ice toward the river, and also longitudinal beams for the support of the screen-house superstructure. The piers similarly carry, in addition to the screen structure, five lines of longitudinal beams for the screen-house floor, the vertical steel-concrete columns of the superstructure and a curtain wall dipping below the water line on the outflow side of the screen house. The screen-house floor is 5 ft. above the assumed low-water level in the forebays, and the front curtain wall is deep enough to extend 4 ft. below low-water level and the rear curtain wall 3 ft.

The design of the reinforcement is outlined in the accompanying transverse and longitudinal sections of the building. The main members of the substructure columns are 1-in. vertical rods tied together with ½-in. rods. The inner group of vertical rods of each column is continued a short distance above the screen-house floor, where they are fastened to the upright rods of the reinforcement of the superstructure columns. Of the two beams carried by the substructure columns, one forms part of the curtain wall, and in this and other respects this curtain is quite different from that of the intake. It is but 10 in. thick, as compared with the 21 in. of the intake curtain, but is expanded at its lower edge into a beam, and is furnished with a reinforcement between the beam at the lower edge and that under the level of the screen-house floor with a system of 5/16-in. vertical rods placed close to each face. The rear curtain is of the same construction.

The piers, as shown, are 24 in. thick where they carry the heavier loads, that is, along the rear wall of the screen house, and are 18 in. thick where they are extended forward for the screen structure. The main members consist of 1-in. rods with ½-in. horizontal tie-rods bent around them, as shown. While the space immediately over the screens will be left so that it can be reached from the screen house, portable flooring will be laid over this part of the building, and for carrying it there are transverse beams extending from each pier to the corresponding substructure column. The construction of these beams, and the longitudinal beam which each carries, close to the front wall of the building, is also shown. The transverse section shows how the main rods of both the substructure columns and the piers are embedded in the bed rock of the river and also the sand trap, which is a longitudinal trench lined with concrete and provided with covers to be removed successively whenever sand is to be discharged from the foot of the screens through the conduit into which the sand trap leads.

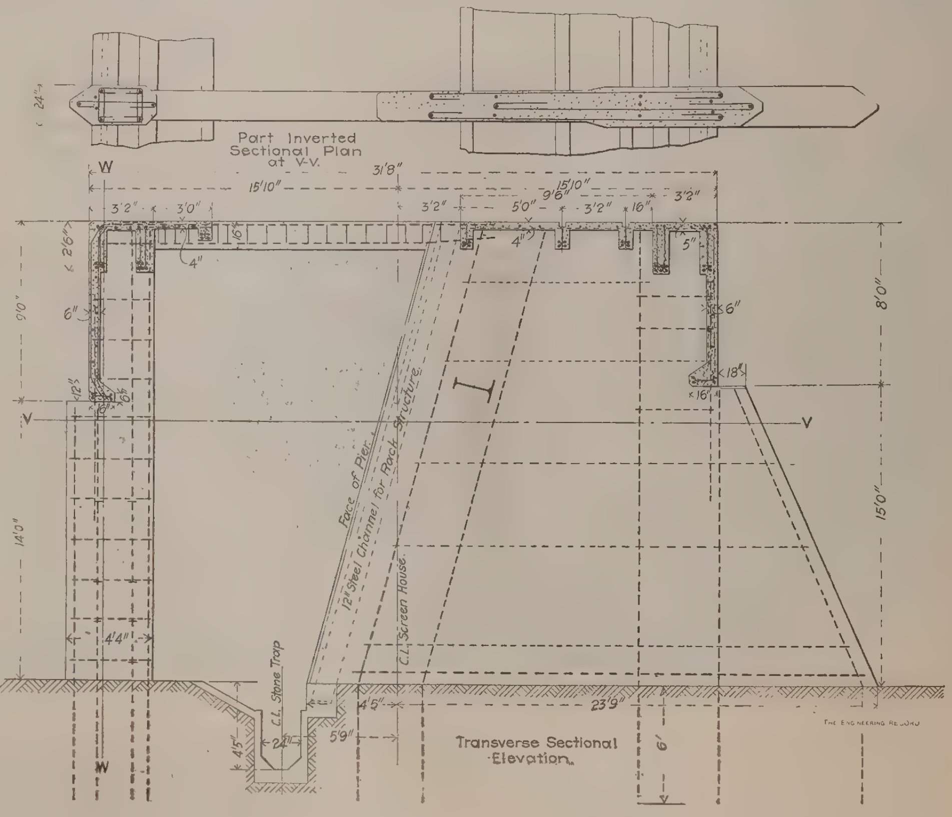
The building walls are divided into panels 20 ft. long, corresponding to the spacing of the substructure piers, and the columns at each substructure column and at each pier carry a transverse beam and a longitudinal beam, by which beams the roof is supported. The longitudinal beams each carry the ends of two intermediate transverse beams, so that the transverse roof beams are spaced along the building at distances 6 ft. 8 in., center to center. The superstructure columns are 12x15 in. in cross-section, with four vertical 1¼-in. rods as the main reinforcement and the longitudinal roof beams are 10 in. thick and 24 in. deep, while the transverse roof beams are 8 in. thick and about 22 in. deep. Those of the latter, which are carried directly by the superstructure columns, are slightly heavier than those intermediate, the group of rods in the heavier beams comprising two 1¼-in. and two 1-in. in size, while those of the intermediate beams consist of a pair of 1⅛-in. rods and a pair of 1-in. rods. The concrete portion of the roof is 4 in. thick, and, of course, in union with the concrete of the beams where it rests on them. It is reinforced with ¼-in. rods lying transversely midway between the upper and lower surfaces and by 5/16-in. rods running longitudinally, half above and half below the transverse rods. The vertical steel members in the beams for taking shear are indicated.

The crane runway rails are carried by concrete-steel girders supported by concrete-steel brackets, of which a sectional detail plan is given among the illustrations. The bracket extends 15 in. from the column to which it is tied, and is 12 in. wide. The way in which the steel members are tied together and fastened to the vertical rods of the column to which each is attached, is shown, and it may be stated that the laterals in the top are 1 in. in diameter. The crane girders are 10 in. wide and 20 in. deep, and similar in design to the roof beams.

The specifications called for a 1:3:5 concrete with 2-in. stone for the substructures, including the curtain walls, and ¾-in. stone for the superstructures. The reinforcement consists of medium steel of 70,000 lb. tensile strength, and all the stresses were calculated on the basis of 16,000-lb. unit stress in the steel and 500 lb. per square inch in the concrete. The Lehigh brand of Portland cement was used.

The sand, obtained from a bank a short distance away, proved to be high in loam, averaging about 11.5 per cent. by volume, and its composition and the results obtained on tests with neat briquettes are of interest. The sand consisted of 6.9 per cent. which passed through a No. 1 sieve; 2.8 per cent. through a No. 2 sieve; 24.1 per cent. through a No. 5 sieve; 20.9 per cent. through a No. 10 sieve; 6.9 per cent. through a No. 20 sieve; 8.5 per cent. through a No. 30 sieve; 11.5 per cent. through a No. 50 sieve; and the balance through 100 and 200-mesh sieves, except, of course, the loam. Tests were made with 1:3 neat briquettes and the results compared with those obtained with 1:3 neat briquettes with the standard sand suggested by the American Society of Civil Engineers; that is, sand all passing through a No. 20 sieve. Such a standard briquette for seven days is credited with a strength of 205 lb. per square inch, while tests made with the sand employed in the work in question showed with 1:3 briquette a strength, at the end of seven days, of 462 lb. per square inch; with a 1:4 briquette, for the same period, 343 lb.; and with a 1:6 briquette, 205 lb., the last figure being exactly equivalent to the 1:3 standard briquette. A series of twenty-eight-day results were also obtained, comparing the figures with the 276 lb. credited to the standard briquette for this period; a 1:3 briquette gave 516 lb.; a 1:4 briquette, 429 lb.; and a 1:6 briquette, 281 lb.

Attention is called to the considerable area over which a relatively small amount of concrete was distributed. For example, in the entire screen house, both in the substructure and the framework of the superstructure, there are less than 1,100 cu. yd. distributed over a length of 322 ft., or less than 3½ cu. ft. per running foot. Similarly, for the 600 ft. of intake structure, the total amount of concrete will amount to about 3½ cu. yd. per running foot. The head block, owing both to its location and to the relatively large volumes of the concrete work, did not present the same conditions. The total amount of concrete comprised in the contract for the headwork structures described will amount to about 7,000 cu. yd. Owing to the fact, among other things, that the rock excavation necessary for the intake structure has not been entirely executed, work has not yet been started on this portion of the headworks, but the head block and the screen-house foundations and framework have been completed. This work was started about Sept. 10, and between that date and Nov. 15 the bulk of the work was entirely completed, and the contractor, the Reinforced Cement Construction Co., of New York, considers the expedition with which the work was performed as noteworthy.



Cross-Section through Screen House Substructure, Ontario Power Co.

Four concrete mixers were employed, two for the head block and two for the screen house. The concrete plant for the head block was erected in the inner forebay and toward the inner wall, so that materials were readily discharged to it from the adjoining bank. Arrangements were made with the local street railway company for hauling the sand from the sand bank and cement from the railroad cars. Separate hoppers were provided for the crushed stone and the sand, and alongside of these a cement house was provided with a chute for sending the bags of cement from the top of the bank to the cement-house door. The mixer of this particular plant rested on the floor of the forebay below the level of the floor of the cement house, and the mixed concrete was dumped into a bucket which was lifted in place by a derrick of the stiff-leg type with a 90-ft. boom. For the screen house the contractor had to lay down a working track for the delivery of the materials and a self-propelling derrick was used, mounted on another set of rails parallel with the screen house, to lift the bucket to the point of use. Here concrete was mixed in quantities of 1 cu. yd. each, and was dumped from the bucket to be shoveled into the forms.

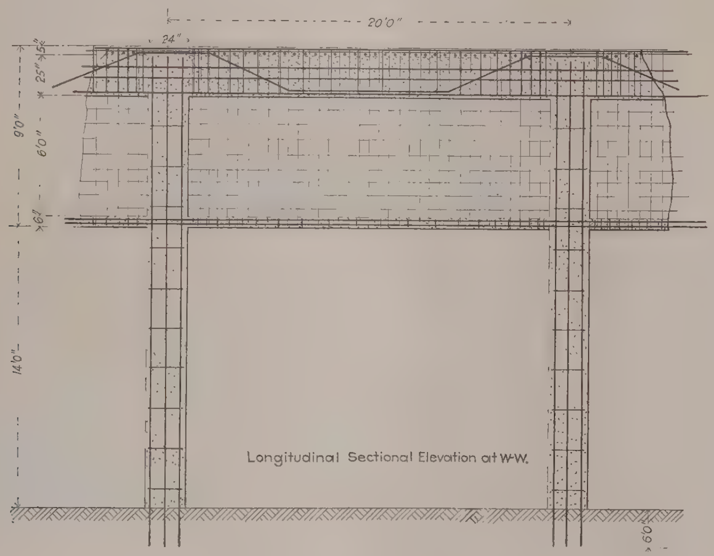
The difficulties of the work were due to two causes. There were few railroad facilities, and these were more or less congested on account of the large amount of work now in progress in the immediate vicinity on the Canadian side of the river. Labor was difficult to obtain also on this account, for not only was there a considerable demand for it in connection with the general power developments, but the town itself was engaged in a considerable amount of sewer work. The fact that the concrete for the screen-house structure had to be handled in small lots on account of the small sizes of the forms was also more or less of an obstacle to rapid erection. Altogether some 400,000 ft. of timber were required for the forms of the screen house and head block, and the quantity made it advisable to erect a wood-working mill, where a small harvesting steam engine unit and a circular saw were provided, enclosed in a light wooden house. Lumber planed on one side was, of course, purchased, but the power-driven saw was desirable both for cross-cutting and ripping. This house was erected in the forebay immediately below the bluff of the inner bank.

The reinforced concrete work described was designed and constructed by the Reinforced Cement Construction Co., under the supervision of the Niagara Construction Co., Ltd., of which Messrs. L. L. & P. N. Nunn are engineers, and Mr. O. B. Suhr is resident engineer. The working force varied from 50 to 100, not including the engineers, foremen and carpenters. The enclosure of the superstructures was not included in this work, as concrete blocks are to be employed. Messrs. Green & Wicks, of Buffalo, are the architects for the buildings, which are designed with reference to their location within the confines of the Queen Victoria Niagara Falls Park. The intake structure is to be undertaken next spring, and by contract must be completed within sixty working days.

Bronzes for Steam Uses.

The manufacture of bronze castings for steam uses is a process which concerns the engineer very little, as the success or failure of the castings themselves is all that he cares about. Nevertheless there are certain features of the manufacturing methods and the proportioning of the ingredients which influence the quality of the casting so strongly that some statements on the subject are here reprinted from a paper read before the Franklin Institute last month by Mr. Strickland L. Kneass.

The chemical union of copper and tin in more than one or two proportions is disputed by many authorities. Be this as it may, in the actual behavior of the binary alloy in the foundry, owing to imperfect mixing or to other reasons, there is almost always found a certain amount of liquation and a proportion of eutectic alloy which affect the physical characteristics.



Screen-House Curtain Wall, Ontario Power Co.

This subsidiary alloy is much more in evidence, and its presence and amount of greater importance in the mixtures of copper, tin, lead and zinc for steam purposes. Here there is always liquation, depending upon the form and size of the section and the rapidity of cooling. For this reason, great care is required to obtain a perfectly homogeneous mixture, approaching as nearly as possible a chemical alloy, free from microscopic pin holes due to shrinkage or to occluded gases, and without the harder spots or lumps of eutectic alloy of the constituent metals. The rapidity of melting, temperature of pouring and the condition of the mold itself, affect the results.

The essential characteristics of a good steam metal are, homogeneity, solidity, tensile strength, rigidity, facility for machining, fluidity in casting, and non-corrosiveness, all being supplied by the various mixtures of bronze in use in varying degrees of excellence. With reference to the composition it may be said in general that homogeneity depends upon the causes already cited; tensile strength and rigidity upon the proportion of copper to tin and their preponderance over the lead and zinc, while the form and character of the chip is determined chiefly by the percentage of lead and fluidity by the zinc. The proper mixture for any desired purpose must, therefore, be a compromise, with a fixed tendency toward homogeneity and density.

Bronze castings, both finished and unfinished, are subjected in service to two serious deteriorating agencies, namely, the attrition and the solvent action of the contained fluids. These effects are scarcely noticeable on the rough casting, surfaced as received from the mold or after subjection to the sand blast or cleaning bath, but finished surfaces are often seriously affected. The same result that is obtained in the laboratory by etching polished sections, occurs in practice on an exposed valve or seat, except that the final result is not so satisfactory; the more soluble metals or alloys are dissolved by the acidulous or alkaline solution, leaving the more resisting and harder eutectic alloy to protrude above the surfaces, preventing continuous contact between the valve faces. Further, the high velocity of the fluid passing through a throttled valve, cuts out the softer parts and a bad leak and defective seat soon result. The porosity of the casting deserves serious consideration, even though the openings be not visible to the naked eye.

Referring to the effect of attrition in special cases, it may be said that when an injector for feeding boilers is operated at its minimum capacity, the velocity of the jet of water and partly condensed steam may reach 800 ft. per second, with a side pressure against the walls of the tube of from 80 to 100 lb. per square inch. If to the passing fluid be added a percentage of sand or dirt often contained in the water supply, the abrasive effect is rapid. A stream line carrying 200 lb. pressure gives a maximum velocity of discharge through a throttled valve of 1,400 ft. per second. Hydraulic valves made of bronze are frequently subjected to a pressure of 4,000 lb. per square inch, and the velocity of the water or oil through the constricted orifice between the supply and exhaust may reach 2,400 ft. per second during the opening or closing of the valve. The abrasive effect in the cases cited is therefore obvious, and any defect in the surface of the metals exposed to such action is sure to cause rapid deterioration in the operation and efficiency of the device.

One of the most obvious causes of variation of the quality of steam bronzes is careless mixing of the fluid metal before pouring, yet it is seldom that this is thoroughly done. The great difference in the specific gravities causes the lead to preponderate at the bottom. An extreme case of this kind was proved by specimens, taken from similar castings, poured from the top and bottom of a bail-pot without special stirring; only a trace of lead was found in the first specimen, and the chips curled like steel turnings; the casting from the bottom of the pot contained three times the required amount of lead, was of a dull color and unfit for use.

The effect of rapid cooling is well known, and is used successfully with almost every metal or alloy. In the proper production of the steam bronzes it is of great importance and produces a marked effect, increasing the density, reducing the porosity and rendering the etched section much more uniform, causing a great reduction in the amount of liquation and the number of projecting points of the eutectic alloy.

Unless excessive internal pressures are used, high ultimate tensile strength is seldom needed, as it is customary to increase the section rather than sacrifice other qualities. When the strength is increased by the addition of aluminum or phosphorus, the expense of remelting the enlarged gates and risers becomes an important item, and there is additional risk of porosity in castings of variable section. Rigidity of form, on the other hand, is of great practical value; so that under strain the castings may not lose their original form or alignment. For all ordinary commercial uses of the steam bronzes, an ultimate tensile strength of from 27,000 to 30,000 lb. per square inch is sufficient, and to obtain this value, as well as both homogeneity and solidity, careful and conscientious treatment in the foundry is required.

The characteristics of any one mixture of metals producing a steam bronze, vary with the conditions under which the castings are made. Authorities recognize this fact and give a maximum and minimum value of the specific gravity, because no absolute value can be taken. The location of the casting in the mold, the size of the section, the contiguity of large and small masses, as well as the conditions already referred to, affect the density and the homogeneity. Where a large and small section are contiguous, it is advantageous to place the heavy part of the pattern, having the larger volume in proportion to surface, in a position where it shall be filled by the first poured and cooler metal; it has been found better in certain cases to place the heavier part above and then gate from the lower end of the smaller section. As the larger part is filled with metal at a lower temperature, it cools in about the same time or slightly in advance of the metal in the smaller section, producing a dense casting, free from shrink holes.

In the discussion of the paper, Mr. G. H. Clamer mentioned one important factor, which, he said, will produce a metal sufficiently dense to withstand the high pressures which such an alloy is called upon to resist. This is the admixture to such an alloy of a small quantity of lead. It has long been known by foundrymen that a mixture of a small quantity of lead will produce this effect, and, further, it facilitates the machining of castings which contain it. An interesting experience bearing on this subject is as follows:

In the time of the old bronze cannons, which were made from an alloy (known as "cannon bronze") of copper and tin, a certain founder had taken a government contract for the manufacture of quite a number of guns of this character. According to the specifications, the government inspectors were required to weigh the charges, see that they were charged in the furnaces, and then the foundryman was held responsible for the castings. These guns were subjected to certain pressure, and, after repeated failures, the manufacturers, being familiar with the value of lead in the alloy, decided to have some molds made of the exact shape in which pure tin was marketed. One night they melted the tin which they had on hand, and added a certain small percentage of lead, then poured it into molds, and when the inspector came the next day he weighed the pigs, which he had no reason to suspect were anything else but pure tin. The mixture was then made up in the usual way, and to the utter surprise of the government officials the castings from that day all came up to the full requirements.

The Water Filtration Works at Philadelphia.

Although the works for the purification of the Philadelphia water supply have been described in this journal, the great detail of these articles has doubtless overshadowed the most important feature of the works, their enormous capacity. For this reason attention is called to some interesting statements concerning the four plants, Torresdale, Lower Roxborough, Upper Roxborough and Belmont, which were made by Mr. John W. Hill in a recent address before the Union League Club of Philadelphia.

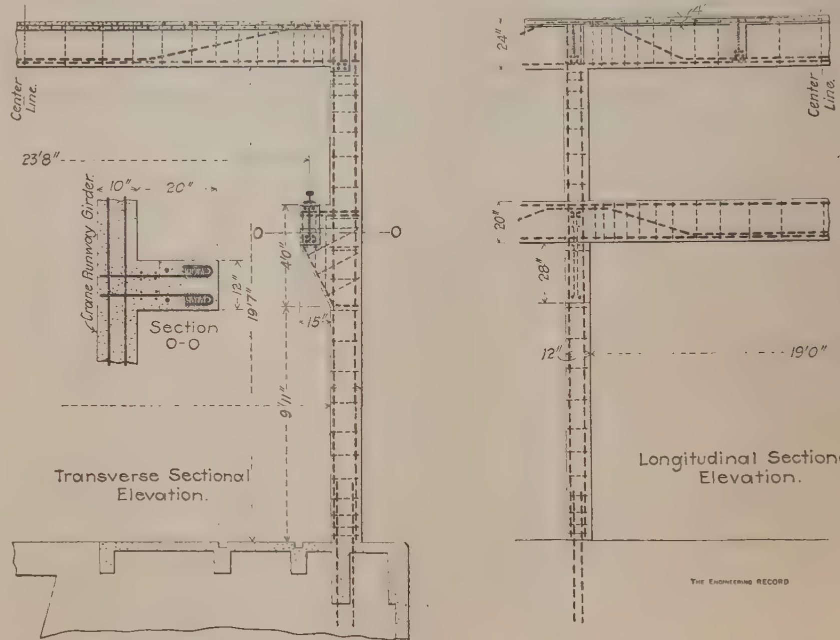
The original capacity of the Torresdale filters (Eng. Record, Feb. 6 and 13, 1904), will be 248,000,000 gal. per day, and sufficient land was taken to increase the capacity of this station, if need be, by 200,000,000 gal. more. Thus the works as outlined, without anticipating any changes or additions to Roxborough, will have an ultimate total capacity of 577,000,000 gal. or more than the amount provided by the new works proposed for the cities of New York and London, in each of which cases the maximum capacity thus far discussed in speculating upon the future requirement is limited to 500,000,000 gal. per day.

The Lower Roxborough station (Eng. Record, Dec. 8, 1900; Jan. 3, 1903) draws its water from the old Roxborough reservoir, which has a capacity of about 13,000,000 gal., and represents about one day's supply when the filters are operated at the rate of 12,000,000 gal. per day. This station is provided with a system of preliminary filters (Eng. Record, July 30, 1904), and when the works are operating at the rate of 12,000,000 gal. per day, the final filters will be run at the rate of 6,000,000 gal. per acre per day. In order to demonstrate conclusively the ability of the Bureau to operate the filters at the 6,000,000 gal. rate, one or more of the filters are maintained at or near this rate at all times, notwithstanding the quantity of water drawn from the station at the present time is not up to its capacity.

The Upper Roxborough station (Eng. Record, April 13, 1901; March 28, April 11, 1903), draws its water from the new Roxborough reservoirs, from which it is lifted by low service pumping machinery in the annex to the Roxborough auxiliary pumping station, to the filters. These works have an easy capacity of 20,000,000 gal. per day, but due to lack of pumping facilities it is not possible to run either the Upper or Lower Roxborough works at their rated capacity, and thus instead of furnishing 32,000,000 gal. per day at the present time, only 17,000,000 gal. is supplied.

The Belmont filters (Eng. Record, Sept. 12. 1903), without the preliminary filters, have a capacity of 33,500,000 gal., but with the addition of preliminary filters, one installation of which is now under construction, the capacity of the present system of plain sand filters will be raised to 65,000,000 gal. per day. When it may become necessary to increase the capacity of the station beyond the latter amount, sufficient land was taken upon which to build eight additional plain sand filters, each of 0.75 acre area, at which time with the further addition of 30,000,000 gal, of preliminary filter capacity, the Belmont works can easily supply 95,000,000 gal. per day.

The Torresdale filters have been located with regard to the possible introduction of water from impounding sources of water supply on the Delaware, Lehigh, Tohickon and Neshaminy watersheds, should conditions in the future suggest the advisability of abandoning the intake at the Torresdale filters, and drawing the water from very large storage basins located on the watersheds mentioned. The elevation of such basins would be such as to deliver the water by gravity to the Torresdale filters. If the physical conditions of the water source or sentiment of the people in the distant future demand a change of the source from which the raw water is drawn, no portion of the Torresdale filtration works would be lost at that time excepting the pumping machinery and station for the lifting of the raw water from the Delaware River to the preliminary filters. Even if the water was drawn through long aqueducts from these distant sources, it is a question whether it would not be advisable to always maintain ready for service the low service pumping machinery at Torresdale in case of accident to the aqueducts or depletion of the storage sources of supply. From this point of view no portion of the work that is now being carried out under the general title of the Torresdale filters would be abandoned even should the water in the future be drawn from the Delaware Water Gap, or some other distant point.



Screen-House Concrete-Steel Superstructure, Ontario Power Co.

An interesting feature with reference to reservoirs and tanks forming a part of filtration works has been the attempt to secure as nearly as possible watertightness. Realizing that a filter tank 200 ft. long by 135 or 140 ft. wide, carrying water for a depth of 9 ft., could not be as tight as a glass bottle, a standard of leakage was fixed to which the filters were required to comply. This was 1,000 gal. per day for a 0.75 acre filter, and the leakage test was carried through a period of at least fourteen consecutive days, during which time careful gaugings were made of the loss of water in the filter with proper corrections for weather changes.

Of the 55 filters in the first installation at Torresdale, 19 filters showed an average loss in 24 hours of 244 gal. per day; 15 filters showed an average loss of 488 gal.; 14 filters, 732 gal.; 2 filters, 967 gal. in 24 hours, and 5 filters showed no loss whatever, i. e., the leakage, if any, was so small that it could not be measured with delicate hook gauges. The average leakage for all the filters was 439.2 gal. in 24 hours, or less than half of what was regarded as a fairly allowable leakage for structures containing many thousand lineal feet of mortar joints, and depending almost entirely upon a 12-in. thickness of puddle for watertightness in the bottom.

In considering the total cost of the improvements embraced in the improvement, extension and filtration of the water supply, which Mr. Hill estimates at $26,100,000, it should be borne in mind that a very considerable portion of the expense—more than one-third—is represented by improvements not essentially a part of the works of filtration. Some of these, of course, are made necessary by reason of the construction of the filters in the localities chosen, but much of the expense charged to ordinary betterments would have been required in order to maintain a supply of water to the city entirely aside from the works constructed for water purification.

A very considerable portion of the outlay connected with the improvement, extension and filtration of the water supply of Philadelphia, is chargeable to the very large per capita consumption, 229 gal. daily. It is fair to state, Mr. Hill said, that if the per capita consumption was no greater than that of cities like New York, Brooklyn and Milwaukee, the cost of the works for Philadelphia would be largely reduced, and this fact should be borne in mind in comparing the total cost of the works with the total costs elsewhere.

The consumption of water in London is from 40 to 45 gal. per capita per day, and the consumption in Philadelphia is not less than 200 gal. per capita—from four to five times as great as in London. Thus, the amount of water that would be sufficient in Philadelphia for a population of 1,400,000, would be sufficient in London for a population of 6,000,000 to 7,000,000. At the present time the population of London, within the water purveying district is roughly 6,000,000 people, and allowing 40 gal. per capita, the consumption is about 240,000,000 U. S. gal., or 10,000,000 less than the capacity of the Torresdale filters alone.

Careful consideration of this information will convey some idea of the magnitude of the enterprise which the city has undertaken; and when it is considered that the construction of the works has been limited to less than four years, it will show that upon the part of the city officials and the contractors time has not been lost in forwarding to completion the largest enterprise of its kind ever attempted.

In comparing London and Philadelphia for water consumption, some thought should be given to the fact that Philadelphia is largely a manufacturing center, relatively more so than the city of London; and this would naturally have some influence on the daily water consumption.

To illustrate the working of the filters, Mr. Hill mentioned the results obtained during the week ending Nov. 12, 1904. The average of the effluents of all the filters at Lower Roxborough for the week contained but 8 bacteria per c. c. as against 15,000 in the river water at Shawmont, and 0.5 parts turbidity per million by the silica standard as against 13 parts in the raw water. At Upper Roxborough the average of all the effluents of the filters was 20 bacteria per c. c. and 0.5 turbidity, with the same condition of the raw water as it left the river for Lower Roxborough.

The Schuylkill river at the Belmont pumping station contained 9,600 bacteria per c. c.; when it left the new sedimentation reservoirs forming part of the Belmont works it contained 3,100 bacteria, and the average of the effluents of all the filters was 16 bacteria per c. c., with the same turbidity as shown for the Roxborough filters.

The standard of filtered water in England and Germany is 100 bacteria per c. c., and any water filtered within this limitation is held to be fit for use for drinking and other domestic purposes. In the early discussion of works of filtration for Philadelphia it was thought the bacterial contents of the filter effluents could be reduced to 60 per c. c. As a matter of fact with the filters now in operation it is rare indeed that the bacterial content is as high as 60, and throughout the year it will average less than this number.

It has been held in quite a number of instances that the crucial test of merit of an improved water supply will be shown in the reduction of typhoid fever case rates. Of course so long as only portions of the city are receiving filtered water this test cannot be applied in a broad way. However, so far as it was possible to do so, a very careful investigation was made during 1904 of the typhoid fever rates in Wards 21 and 22, which have received water from the Upper and Lower Roxborough filters, and a portion of West Philadelphia which has been set off and receives only filtered water.

When compared with the remainder of the city, considering Roxborough for a period of 46 weeks, ending Nov. 18, the typhoid fever reduction in Wards 21 and 22, was 55.6 per cent.; when compared with West Philadelphia, 75.4 per cent., and when compared with Wards 23, 25, 33 and 35, receiving water from the Delaware river, 59.5 per cent.

The filtered water section of West Philadelphia represents about one-third of the total population of that district. For a period of 24 weeks, from June 3 to Nov. 11, there were 15 cases of typhoid fever reported for the filtered water section against 240 cases reported for the mixed water section, and assuming the population of the latter to be twice that of the former, there were then 15 cases in the filtered water section as against 120 cases in the mixed water section, showing a reduction in the typhoid fever rates of 88 per cent.

It is confidently believed that when the entire water supply is filtered the reduction in the typhoid fever rate will be 80 per cent., and it is not thought that water from any natural source could probably make any better showing than this, because some of the remaining 20 per cent. of typhoid cases must be attributed to the drinking of water outside of the limits of Philadelphia, as well as to sources of infection other than water.

The National Highway between Amsterdam and Haarlem.

A BOILER EXPLOSION that seems to have expended its force largely in a horizontal direction, though some heavy parts were projected at distances that would indicate some upward pressure, occurred Oct. 6 at Pensacola, Fla. The boiler was one of four horizontal fire-tube boilers forming the steam plant of the Stratton Ice Works, of that city. They were all in separate brick settings, and three of them, Nos. 1, 2 and 3, were in use at the time of the explosion. The boiler that exploded was No. 2, 60 in. x 18 ft. in size, and carrying 100 lb. pressure. According to Mr. J. R. Keller, manager of the company, all four of the boilers were blown from their settings and pushed to the right and left 10 to 15 ft., while less than a foot of the brickwork remained intact above the ground. Directly in front and overhead of the boilers was a large elevated coal bin, which had been filled on the day of the explosion. The bin was supported by iron columns 14 in. in diameter filled with concrete, and the force of the explosion was of such a nature that it knocked the supports from under the bin, causing its collapse; and it was under this bin that the body of the only person killed, the fireman, was found. He was apparently in the act of firing when the explosion occurred.

A Dutch National Highway.

The accompanying illustration shows the general appearance of the government highway between Amsterdam and Haarlem, in the Netherlands, on which an American company has recently built an electric railway, as described in this journal on Jan. 7. The location of the tracks and the brick pavement of the roadway make this road of interest to engineers of other countries, while the widening of the road to carry the tracks was an undertaking of considerable novelty. The work was done under the direction of J. G. White & Co., and involved sheet-piling and filling on both sides of the original embankment, for the road is bordered on one side by a canal and on the other by a ditch. When the work was at its height there were 2,360 laborers at work, two steam locomotives, an electric locomotive, thirty-one steam pile drivers, three steam spouters, a steam crane, sixty hand pile-drivers, a steam bucket dredge, and a fleet of 165 scows. The highway crosses polder land and is below the level of the canal. It is subdivided by ditches which lead to various points where there are windmills to pump the water from the ditches into the canals. The land is of a boggy, peaty character and is used wholly for grazing purposes.

The sheet-piling on the canal side of the highway rests against a line of 16-ft. piles driven on 4-ft. centers. Back of every second pile under the outer rail of the track are two others 10 ft. long, connected by a bearing timber which holds the end of an iron tie rod running to the main pile. The main piles have a 7x8-in. waling piece, behind which a row of vertical sheet-piling was driven. On the ditch side of the road, the main piles were longer and driven on 3½-ft.centers, and tied back to anchor piles like those on the other side of the highway. These piles carry horizontal planking down to an elevation a little below the lowest water level, where a waling timber is spiked. Behind this waling piece vertical sheet-piling is driven.

The filling behind the sheet-piling is sand, which is paved above the level of the sheeting on the canal side with broken brick covered with trap blocks. On the ditch side the slope is sodded.

The New Asbestos Mills of Black Lake, P. Q., Canada.

By E. G. du Mazuel, C. E.

Commercial asbestos is a fire-resisting substance composed of silky fibers up to 6 in. in length, which can be used for packing or woven into fabrics. Its value corresponds approximately with the length of the fiber. It is prepared from a mineral of variable color, which is usually found deposited in thin sheets in the seams of granite rock. The fiber is normal to the sheets and its length is thus limited by the thickness of the seam. The most important deposits so far discovered in America are one of flesh-colored mineral in Arizona and a green deposit at Black Lake, in the Province of Quebec, Canada. In order to secure the asbestos mineral it is necessary to quarry the granite in which it occurs and afterward separate the materials by crushing. Formerly the asbestos mineral was hammered by hand until the fiber was separated and brought to a merchantable condition. This method was slow and expensive, and was improved some years ago by Messrs. King Bros., who devised machinery to work the mineral without breaking the fiber, although some hand work was still required for the long fibers which were most easily broken in the machines.

The Black Lake asbestos mines are about 50 miles from Sherbrooke, on the line to Quebec, and are the richest deposits known in Canada. They were discovered and opened by Mr. Walter Kerr, who operated them for several years by the old hand methods. Recently a company has been organized and special machinery installed, which greatly increases the capacity and provides a superior quality of finished product.

The mines, of which there are several, are located within a radius of one mile from the mills, with which they are connected by a wagon road and narrow gauge railroad. The mineral now is quarried in open pits to a maximum depth of about 50 ft., the granite being drilled by steam and blasted with dynamite. The granite is rejected and the asbestos mineral loaded on dump cars and delivered to the mills over a high wooden trestle, from which it is discharged to the bins and supplied to jaw crushers, which break it into 2-in. pieces. From the crushers it is delivered by bucket elevators to cylindrical screens in the top of a two-story mill. The large pieces are returned to the crusher, and that which passes through the screens is discharged into long cylindrical dryers, in which it is heated until all dampness is removed.

After being dried, the mineral is taken up by a rock hopper and served to several rows of crushers, thus being reduced little by little, till it reaches the emery grinders from which the poorest grade of asbestos is derived. These rows of crushers placed on the second story of the mill reduce the mineral to small pieces several inches in length, and pulverize the particles of rock which still adhere to it. The mixed rock and asbestos is thence passed through beating machines that stamp it and deliver it to slightly inclined flat screens with 1/16 to ¼-in. mesh. Here all the remaining granite is separated from the asbestos and the latter is removed by pneumatic dust collectors and thrown into the combers, delivering A1 grade. The residue is elevated to the second story and passes again through a double set of small rotary crushers and beaters to give the A grade of fiber. The residue from the A grade is a third time elevated and passes through a last set of crushers and beaters, giving the B grade. The final remnant is a small percentage of the original amount and is carried to an emery grinder making 600 r.p.m., which separates the shortest fibers, known as the C grade.

The combers are special machines, each consisting of a pair of horizontal revolving cylinders with rows of radial teeth meshing between rows of similar teeth in the concave surface which encloses the cylinders. The cylinders are driven in opposite directions so as to revolve toward each other, and the asbestos being deposited in a hopper on top of them, is drawn between them and its fibers are gradually worked into position parallel with the rows of teeth and carried around the cylinders to be discharged from their under side. The beaters are wooden boxes 4 ft. square and 8 ft. long, each of which contains four horizontal shafts 8 ft. long. Each shaft is provided with curved arms, which clear each other when the shafts revolve in opposite directions and throw the mineral and stones from side to side, back and forth, gradually separating them and discharging the stones through the bottom of the box. The by-product from the machines is a very fine sand, which is received on a belt conveyor and delivered to the waste pile. This sand contains most of the properties of asbestos and would probably prove valuable if some experiments and investigations were made to develop practical uses for it.

The mill has a capacity of 25 tons of mineral per hour, and the plant is operated by a total force of one hundred men, two-thirds of whom are employed in the quarries. Both quarries and mills are owned and operated by the American Asbestos Co.

Letters to the Editor.

THE EFFECT OF DYNAMITE.

Sir:—I see in one of your late numbers some remarks about dynamite and its use which convince me that for an explosive that has been used so long as that substance has, little seems to be known about its effect. There is talk among a great many people about dynamite acting downward in exploding, because when laid on a stone with nothing but the air to react against it, it shatters the stone. The truth is that dynamite acts in all directions; but of course when in one direction it has only the air to react against, its force is not recognized. If the air were colored more thoroughly than it is, we should probably see a pretty violent turmoil in it.

In submarine blasting with dynamite, when the explosion takes place the pressure acts with equal force in every direction; but being surrounded above with water, it always takes the easiest direction in which to escape, and that is vertically upward.

Its tremendous energy will cause it to shatter rocks in its immediate vicinity; but, in attempting to remove large masses by it, it is so energetic that the strength of the material and its weight are not sufficient to overcome the inertia of the mass to any great distance from the location of the charge, which consequently shatters it in the immediate vicinity of the charge, but only extends a short distance.

I noticed last winter accounts of attempting to remove ice gorges in rivers by the use of dynamite, with very unfavorable results. The material to use for this purpose would be black powder, rather slow burning, in hermetically sealed tin cans, and exploded by electricity, which would remove much larger masses of ice, and set them floating down the stream.

In blasting rock in a street, if the blast is well covered to prevent stones from flying, dynamite is best, as it is less liable to disturb adjacent buildings, for the reason given above.

I write this because I think it should be better understood.

Very truly yours, L. L. BUCK.

BRIDGE FAILURES.

Sir:—Will you allow me to comment upon a remark in your editorial on the "Failure of the Charleston Suspension Bridge," in your issue of Dec. 31, 1904? You make the following observation: "The mere failure of an iron or steel bridge, with accompanying loss of life and property, has unfortunately not been a very rare occurrence. Such wrecks, however, have been due to defects in design through which the full section of the metal has been stressed beyond its carrying power and failed, as it should. These sources of weakness are not attributable either to bad quality of material or lack of care in maintenance or usually even to unreasonably heavy loads."

I cannot believe that this statement correctly expresses the idea which the editor had in mind. It has been one of the stock arguments of the opponents of "iron" bridges in the days when it was iron against wood that iron was unsafe because liable to sudden rupture without warning, injuriously affected by extremes of temperature, and from the nature of the metal itself untrustworthy, even when used by competent designers. On the contrary, the earliest builders of iron or steel bridges, beginning with Squire Whipple more than fifty years ago, and coming down to the experts of the present generation, have always claimed that an iron or steel bridge, properly built and properly designed and maintained, is as durable and trustworthy as any such structure of wood, and the experience of fifty years has amply vindicated this contention; so that it would prove to be matter of considerable interest to search the record of bridge failures in the endeavor to find any instance where a bridge has failed by the direct rupture of any member doing its legitimate duty according to the intention of the designer. If you would look over the record of failures for the last quarter of a century, I think it will become evident that nearly all the bridge disasters, involving iron or steel bridges, have been due to some defect or flaw in material or construction for which the engineers were not directly responsible; or to derailment or other accidental occurrence bringing an unforeseen strain upon certain members which they were not intended to carry; or to gross negligence in the inspection and maintenance after years of service. In other words, I think that you will find that the cases are rare in which "a full section of the metal has been strained beyond its carrying power and failed, as it should." On the contrary, the endurance and general efficiency of iron and steel bridges have been remarkable, considering the constant tendency in most cases to overload them. One railroad engineer in discussing the subject showed that old iron bridges might, in case of necessity, be loaded in excess of their loads assumed by calculation to the amount of sixty per cent. without straining the metal beyond its elastic limit.

To cite a few instances at random: The Tay bridge was blown over because of inadequate stability against wind pressure. The Ashtabula bridge was an abortive attempt of an incompetent designer to build a Howe truss with metal, and was erected without proper supervision; and would have been condemned on sight by a competent bridge designer; failure probably due to faulty arrangement of the lateral system. The Forest Hills disaster was due to a cracked and neglected floor-hanger, so bad that for it to do any service at all was almost a miracle. The Chester bridge disaster in Western Massachusetts was due to the criminal negligence of workmen, who left the bridge under repairs during the noon hour with only a few bolts in a vital joint. Other cases of derailment in which a defective floor system or something else has brought side strain on trusses so as to cause collapse. Of course, there have been many light and badly designed highway bridges, in cases where both the buyers and builders aimed to erect the "cheapest" possible bridge, which were accepted by commissioners, who in such cases usually ignore the opinions of bridge experts.

The comment which the engineering profession can usually make upon such sad occurrences are to the effect that the iron and steel have usually done their duty remarkably well, and persisted in holding up to their task when the experienced bridge-man would say that they should have failed long ago, and it must always remain true that an iron or steel bridge, properly designed and efficiently maintained and used according to the intention of its designer, has in every case proved entirely satisfactory and capable of indefinite endurance.

Yours very truly, ROBERT FLETCHER,
Thayer School of Engineering.

THE EFFECT OF FOG on the consumption of illuminating gas is shown in a report for Sheffield, England, where it is stated that the demand was increased from 15,000,000 cu. ft. per day, the normal daily consumption for the season in question, to 18,000,000 cu. ft.

CURRENT NEWS SUPPLEMENT

JANUARY 14, 1905.

DIRECTORY OF NATIONAL ENGINEERING SOCIETIES.

American Society of Civil Engineers. ecretary, Chas. Warren Hunt, 220 West 57th St., New York. Annual meeting, New York, an. 18 and 19.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John St., New York.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South Fourth St., Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water St., New York. Annual meeting, Hotel Astor, New York, Jan. 17-19, 1905.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St., Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Paterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

American Water-Works Association. Secretary, J. M. Diven, Elmira, N. Y.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

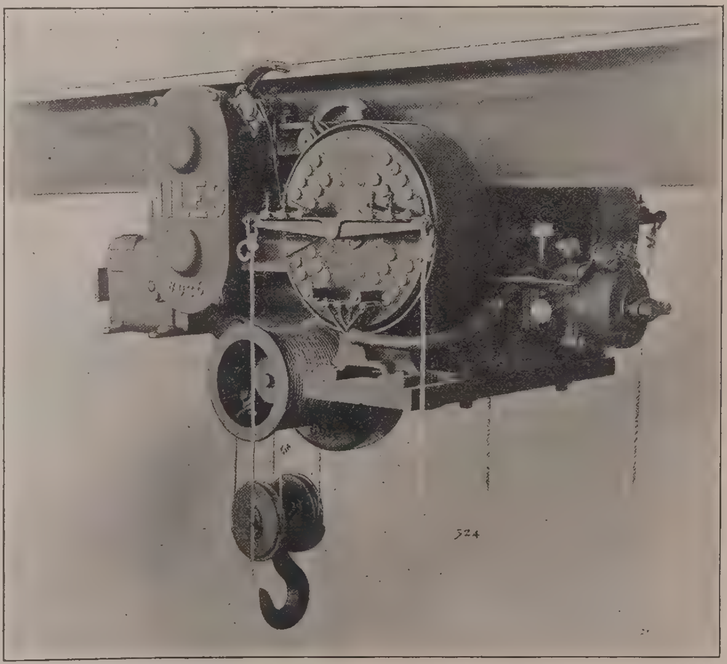
AN ELECTRIC TRAVELING HOIST.

The accompanying illustration shows the general features of a type of electric traveling hoist which has been designed by the Niles-Bement-Pond Co., New York. It has been worked out in various sizes of ¾ to 6 ons capacity, and is usually arranged to run on the lower flange of an I-beam track. They will run on straight and curved tracks, and are generally provided with a separate motor for traversing, but if desired, hand traverse may be furnished, or all the traversing mechanism may be omitted and the trolley moved along the track by pushing on the load. The increase service of the electric traverse, however, much more than compensates for the slight additional cost.

The hoist is self-contained in one heavy cast-iron frame to which the motors are attached end on, and the power is transmitted directly from the armature shaft to the drum shaft through one train of worm and worm-wheel gears. The traversing mechanism is also driven through one train of worm and worm-wheel gears, similar to the hoisting mechanism, except that, when the trolley is arranged to run on a single I-beam, a double set of transmission gears are used. All the mechanism is enclosed in oil and dustproof casings, and is absolutely noiseless in operation.

In addition to the braking effect obtained by the use of the worm and worm-wheel, a powerful electric brake is attached to the hoist motor.

These hoists when mounted on a traveling bridge may be used as small-capacity cranes. When used as cranes, the hoists are arranged to run between the two I-beams or channels of the bridge, and the controllers for raising and lowering the hook and operating the traversing mechanism may be placed either on the hoist, on the bridge, and operated by cords from the floor, or in an operator's cage attached to the bridge.



ELECTRIC TRAVELING TROLLEY CRANE.

CAST-IRON PIPE CONTRACTS.

Although the general run of pig iron orders since the opening of the year has been small, there have been a few large transactions, largely with pipe foundries. The market during the first week of the year was recently summed up as follows by the "Journal of Commerce," of New York:

A Southern pipe company is reported to have secured business for the City of New Orleans amounting to 30,000 tons, and has purchased the iron direct from Southern furnaces; but the largest contract is for 50,000 tons, secured by the United States Cast-Iron Pipe Co., the order being placed by the American Pipe Manufacturing Co., of Philadelphia. The contract for 11,000 tons of pipe for the Borough of Brooklyn has not been awarded as yet, but John J. Cashman is the lowest bidder, and will probably secure the business. Another contract for 7,000 tons, placed by the Consolidated Gas Co., of New York, and an additional order for 1,200 tons, for an Eastern gas company, have been placed with the United States Cast-Iron Pipe Co.

ANNUAL MEETING, CANADIAN SOCIETY OF CIVIL ENGINEERS.

The nineteenth annual meeting for the election of officers and members of council for 1905, and for the transaction of business, will be held as follows:

January 24: At 10 A. M.; meeting for the nomination of scrutineers, receiving the report of Council and transaction of the general business of the Society. At 1 P. M.; members' luncheon in the rooms of the Society, 877 Dorchester St., Montreal. At 8 P. M.; an address by the retiring president, Col. W. P. Anderson.

January 25: The members are invited to visit the works of the Dominion Bridge Co., the Dominion Wire Manufacturing Co., the Dominion Wire Rope Works, and the works of the Allis-Chalmers-Bullock Co. By courtesy of the Grand Trunk Ry., a complimentary train will be placed at the service of the members, and will leave Bonaventure Station at 10:30 A. M.. Returning to Montreal, the train will leave Rockfield Station at 4 P. M. The Dominion Bridge Co. will entertain the party at luncheon at noon. At 8 P. M., members' annual dinner in the Windsor Hotel.

January 26: At 10 A. M., a meeting for the reading of technical papers will be held. At this date the following papers are announced:

"The Construction of the Canadian Niagara Power Company's Plant, Niagara Falls, Ont.," by C. B. Smith, Ma.E., M. Can. Soc. C. E.

"The Effect of Load Factor on the Cost of Electric Power," by E. M. Archibald, B. Sc.

"Maps and Map-Making in Canada," by Jas. White, Geographer for the Dominion Government.

At 3 P. M., meeting for the reception of reports and concluding the business of the annual meeting. At 4:30 P. M., meeting of the newly elected Council.

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.

The eleventh annual meeting of the American Society of Heating and Ventilating Engineers will be held in New York City, Jan. 17, 18, and 19, at the Hotel Astor, Broadway and 44th St. The following papers and topics for discussion are announced:

Tuesday evening: "Appliances and Results in Exhaust Steam Circulation," by James A. Donnelly. Topics: The relative advantage of low-pressure and vacuum systems for small work in residences; the ventilation of tunnels, subways, and kindred constructions.

Wednesday afternoon: "Investigation of Accuracy of a Direct-Reading Hygrometer," by Prof. R. C. Carpenter; "Gas as a Fuel for Hot-Air Heating," by R. S. Thompson; "Steam Heating in Connection with Condensing Engines," by Reginald Pelham Bolton. Topics: Grate and heating surface, and their relation to space and exposure in furnace heating; the requirements of heating boilers, using bituminous coal. In the evening the annual dinner of the society will take place.

Thursday morning: "Experience with Radiators in Top Story of a Building," by A. B. Reck; "Circulation of Hot Water," by John S. Brennan. Topics: Advantage of low-pressure hot-water heating systems with the velocity of circulation increased by force or vacuum; methods of heating large bodies of water for public baths and industrial purposes by steam or otherwise.

Thursday afternoon: "European Methods of Heating, Fifty Years Back," by Prof. R. C. Carpenter. Topics: The efficiency and durability of internally fired boilers, Scotch marine type with Morison furnace, compared with horizontal tubular boilers, for ordinary power plants at 100-lb. pressure; methods of improving the society's records of the practice prevailing in different systems of heating; proportion of grate surface required for different fuels; the extension of the work of the society in special fields; the increased efficiency of heating apparatus using a fan; the attitude of engineers to the society.

CEMENT USERS CONVENTION.

The convention of cement users at Indianapolis, which has been organized by C. C. Brown, of "Municipal Engineering," will meet Jan. 17-19, at the Claypool Hotel. It is stated that there will be a great variety of concrete users' machinery and tools on exhibition, including 15 concrete block machines. The list of papers promised is as follows:

The Determination of the Practical Value of Cement and Its Products, by Richard L. Humphrey.

Methods and Results of Cement Testing, by Walter Buehler.

Quality of Sand, by James C. Hain.

Practical Mixing of Mortar and Concrete, by Kirk H. Brown.

The Mixture of Concrete, by A. L. Goetzmann.

The Testing of Cement Blocks, by John R. Allen.

Coloring of Cement, by J. P. Sherer.

Waterproofing of Concrete, by W. H. Finley.

Waterproofing of Concrete Blocks, by G. B. Kirwan.

Practical Work of Constructing Sidewalks, by Albert T. Gridley.

Cement Posts, by J. A. Mitchell.

It is also proposed to discuss the permanent organization of a cement users' association, and to take up any technical questions which may be propounded.

A NEW WESTINGHOUSE CRANE MOTOR.

Ever since the institution of electric crane machinery the Westinghouse Electric & Manufacturing Co. has been engaged in its manufacture, so that the announcement of the production of a new motor for this service is sure to excite interest as to the general characteristics of the new machine. Type K motors, as they are known, are designed for the operation of cranes, hoists and similar apparatus and for intermittent service in which heavy starting torques and wide speed variation are required. Ten sizes are standard, including capacities from 2 to 40 h.p.

The frames are of the wholly enclosed form, to guard against dirt and moisture, but are designed so that the working parts may be exposed for inspection or adjustment without dismantling. If local conditions permit, the cover about the commutator may be removed and the motor operated open, with improved ventilation and increased capacities. They have four inwardly projecting poles, each of which is magnetized by a separate field coil. They are series wound for operation on direct-current circuits of 220 and 500 volts. Since the current passes successively through armature and field winding, the torque of such a motor increases nearly as the square of the current, up to the point of saturation of the iron. For this reason the series motor is particularly well suited to the starting and acceleration of heavy loads. Governed by change of voltage at the motor terminals, the speed of the motor is carried through a wide range, the change in the resistance of the motor circuit being made by means of a controller.

The motor frames are of cast steel (except in the three smallest sizes, where they are of cast iron). They are compact, nearly square in section and requiring a minimum amount of head-room on a crane, or floor space when used with hoists or similar apparatus. Two poles project inward in a horizontal and two in a vertical plane, and the frame is built in two parts, divided in a plane passing through the axis of the armature and at an angle of 34 deg. with the horizontal, an arrangement which allows the upper half of the field to be removed without disturbing the gears or shaft. The opening around the commutator is entirely closed by a 3/32-in. sheet steel band, fastened by thumb screws, an arrangement which permits access to the commutator and brush holders at all points.

The four pole pieces are built up of soft steel punchings, riveted together between wrought-iron end plates, and are secured to the frame by bolts which pass well into the punchings, but leave the pole face smooth and unbroken. The coils of the larger motors are of copper strap and the terminals are insulated with asbestos ribbons. Being machine wound, they are perfectly interchangeable. The coils are fitted to the pole pieces, protected at the ends by oiled duck and held in place by the spreading tips of the pole pieces.

Shells lined with bronze or babbitt and mounted in housings which may be removed without separating the motor frames, constitute the bearings. Cast brass bearings are standard on all sizes up to and including the No. 4; on all frames above No. 4 babbitt bearings are used. Grease lubrication is employed in all except the larger sizes, the bearings of which are designed for lubrication by oil and waste. Drip cups are provided under the bearings for all motors. The bearing housings may be turned and bolted in several positions without modifications of design or the addition of special parts.

The armature core is built up of soft steel punchings with ducts between the punchings, through which air, drawn in through openings in the spider, is forced out against field coils and core. The commutator is mounted on the armature web, allowing the shaft to be removed without disturbing the winding or connections. Covers of oiled duck adequately protect the ends of the winding. Wiper rings or oil guards are provided at each end of the armature to protect the winding from oil. Adjustment to compensate for wear of the commutator can be made by removing iron washers which are placed under the insulating washers on the stud bolts of the brush-holder gear. With all but the two smaller sizes a shunt is connected to the spring to relieve it of the duty of carrying current.

BUSINESS NOTES.

The Scofield Construction Co., of New York City, has been incorporated, with a capital of $100,000, to carry on a general construction business. The directors are Lyman M. Scofield, of Albany, N. Y., and Glenn M. and Edson E. Scofield, of Philadelphia

The Alpena Portland Cement Co., Alpena, Mich., held its annual meeting on Jan. 5, and voted, according to local papers, to increase the capacity of its mills. Mr. C. H. Reynolds was re-elected vice-president and Mr. John Monaghan secretary.

The Bucyrus Co., So. Milwaukee, Wis., has just booked an order from the Oliver Iron Mining Co., a constituent company of the United States Steel Corporation which controls its Lake Superior mines, for fourteen 90-ton special steam shovels, to be delivered in the spring.

The Hudson Companies of New York City has been incorporated with a capital of $21,000,000 to construct and operate tunnels, railroads and other enterprises in the States of New York and New Jersey. The directors are F. W. Walz, T. J. J. Lackman, William H. Barnum, John A. Keppelman, Gilbert H. Montague, Herbert Scoville and George H. Tower, of New York City; Ross A. Mackey, Brooklyn; William E. Kenney and Lewis E. Waring, Plainfield, N. J., and A. W. Westervelt, Englewood, N. J.

The John J. Hearn Construction Co., of New York, has been incorporated, with a capital of $25,000, by John J. and Ellen G. Hearn, of New York, and Wm. Hearn, of Brooklyn.

The Standard Ferro-Concrete Co., of New York, has been incorporated, with a capital of $75,000, by Philip B. Cavanagh, A. C. Bradford and Clyde Colt, of New York.

The Coosa Pipe & Foundry Co., Gadsden, Ala., has been incorporated, with a capital of $50,000. Among the incorporators are E. B. Thalman, of New York; Col. T. G. Bush, G. B. McCormack and Erskine Ramsay, of Birmingham.

C. Herbert Holcomb has organized the Holcomb Steel Co., at Syracuse, N. Y. The company has a capital of $460,000, and it is reported that President F. R. Hazard, of the Solvay Process Co., and President L. C. Smith, of the L. C. Smith & Bros. Typewriter Co., are interested in the company.

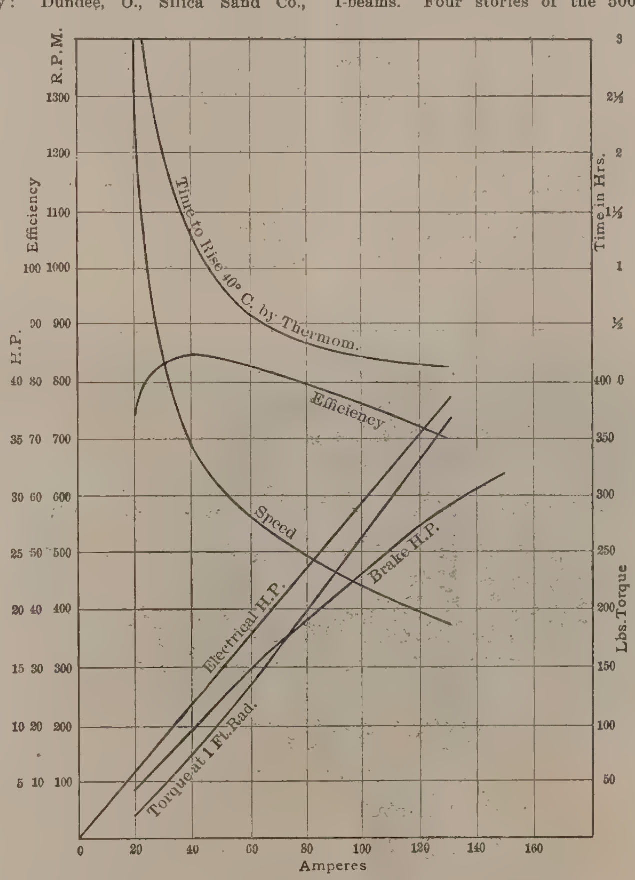
The Consolidated Water Improvement Co., Camden, N. J., has been incorporated, with a capital of $500,000, to manufacture water filters. The incorporators are Geo. H. B. Martin, F. R. Hansell and Jos. F. Cotter.

The Thomas J. Brady Co., New York City, general contractor, has been incorporated, with a capital of $100,000. The directors are Thomas J. Brady and Wm. W. Ewing, of New York, and John Guilfoyle, of Brooklyn.

The Raymond Concrete Pile Co., of Chicago, Ill., has been awarded the contract for over one thousand concrete piles for the foundation of a new building which is to be built for the use of the Troy Laundry & Machinery Co., at 23d and La Salle Sts., Chicago. The building will be seven stories in height and will have to carry very heavy machinery. The work is now in progress. Jenney & Mundie, of Chicago, are the architects and Ritter & Mott are the engineers for the building. The Raymond Concrete Pile Co. expect to begin work next week on a job of 800 piles for a large warehouse in St. Louis, and state that the indications are that a great many Raymond concrete piles will be used in various parts of the country during the present year.

The Brown Corliss Engine Co., Corliss, Wis., has just received an order from the Illinois Steel Co., for a 2,000 h.p. Corliss engine for its Joliet plant. This engine is of the type having both horizontal and vertical steam cylinders driving the same crank shaft.

The C. O. Bartlett & Snow Co., Cleveland, reports the following recent sales of machinery: Dundee, O., Silica Sand Co., elevating and conveying machinery; Leisy Brewing Co., Cleveland, tube barley conveyor; Pattison Supply Co., Cleveland, coal conveyor; T. S. Henderson & Co., St. Louis, special cable conveyor; C. L. Holck & Co., Monterey, Mex., mining machinery; Royal Crown Lead Co., Detroit, paint machinery; Memphis, Tenn., White Lead Co., paint machinery; Moore Bros., Cleveland and New York, paint machinery; Lowe Bros., Dayton, O., paint machinery; International Harvester Co., Chicago, paint machinery; Independent Stone Co., Cleveland, two steam hoists and derricks; Underwriters' Land Co., Carthage, Mo., large ore dryer; Lorain, O., Supply Co., Style E rotary dryer; Berg Co., Philadelphia, Triumph steam dryer; General Chemical Co., Cleveland, direct heat dryer; Brightman Chemical Co., New Brighton, Pa., salt rotary dryer; Ross Keller, Triple Pressure Machine Co., St. Louis, Mo., direct heat rotary dryer.



CHARACTERISTICS OF THE WESTINGHOUSE TYPE K CRANE MOTOR.

The Passaic Steel Co., 7 Nassau St., New York., is operating its plant at full capacity, day and night, and making and selling about 6,000 tons per month of open-hearth shapes. The bridge shop is so full that some of the contracts are sub-let. The work in progress includes a four-track deck bridge about 1,500 ft. long, with eleven 125-ft. spans, for the New York & New Haven R. R., at Coscob; three movable cargo towers 111 ft. high, for the Pennsylvania R. R. Co., at Greenville, N. J., and the steelwork for the elevators in 40 shafts of the underground railroad, London, England. They are also making the beams, girders and columns for a large number of buildings, mostly in New York City and vicinity. The bridge shops are running double turn and are shipping about 2,000 tons of bridge and structural steelwork per month.

The Thompson-Starrett Co., 49 Wall St., New York, has just completed the steel-frame Orchestra Hall Building, Chicago, and the concrete pier foundations for the new Telephone building and the Fort Dearborn buildings, Chicago; erection of the 16-story Rockefeller building, Cleveland; the Garrick Theater, St. Louis, and the first section of the Wanamaker department store, Philadelphia. The steelwork is erected for the 12-story Produce Exchange Bank and for the 10-story warehouse for C. A. Schieren, at Cliff and Ferry streets, New York. The latter building has a 1400-ton steel framework of exceptionally heavy design, calculated for live loads of 200 lb. per sq. ft. on every floor, and has a grillage foundation of heavy steel I-beams. Four stories of the 500-ton steel framework of the Brooklyn Rapid Transit Company's 10-story office building are erected; in Washington, D. C., the massive concrete substructure work is nearly completed and the erection of the steel superstructure has been commenced for the terminal station, a 7-story bachelor apartment house for Totten & Ward is being erected, and a large contract has been taken for the granite work in the National Museum. In Baltimore, repairs amounting to the reconstruction of the whole interior, except the steel framework, and nearly all of the outside walls of the 16-story Continental Trust building are nearly completed.

Turbo-generator contracts closed by the Electric Co., to be used in lighting and power work in that city; two 1,500-kw. outfits for the Rochester, Syracuse & Eastern R. R., and one 1,000-kw. outfit with exciter for the Springfield Electric Light Co., Springfield, Mass.; also a 300-kw. turbo-generator with exciter for the Northern Electric & Manufacturing Co., of Montreal. The company has received an order through its agents, Takata & Co., of Tokio, for thirteen direct-current generators, each of 62.5-kw. capacity, and thirteen spare armatures. Each generator will be driven by a 125-h.-p. steam engine, ar the thirteen engines will be supplied by th Westinghouse Machine Co. The Westinghous Electric & Manufacturing Co. also has sold the International Paper Co., for use in i plant at Berlin, N. H., one 250-kw. alterna ing-current generator of the revolving arm ture type, three 40-h.-p. alternate-current m tors, with switchboard, transformers, etc. Th same company has sold to the Detroit Unite Railway Co. a 1,500-kw. railway generato and a 250-kw. booster set. These machin are in addition to four other large railw generators of an aggregate capacity of 5,0 kw. which the Westinghouse company has a ready installed for the Detroit company.

The Burt Mfg. Co., Akron, O., has ju made a shipment of 21 oil filters to its agen at Havana, Cuba; 9 oil filters and 6 exhau heads to the agency at Sydney, Australia; oil filters to the agency at St. Petersbur Russia; 3 oil filters to the agency at Calcutt India; 4 oil filters to Spain; 2 20-in. exhau heads to the agency at London, England; 10-inch exhaust head to the American Ste and Wire Co.; 1 24-inch exhaust head to t National Steel & Wire Co.; a 120-gallon Cro oil filter to the National Tube Co., McKee port, Pa., making 73 exhaust heads and 1 oil filters now used by the United States Ste Corporation; an oil filter to the Munisin Mich., Paper Co.; one to the Singer Sewi Machine Co., to be used in connection wi the Siegrist oiling system; Atlantic Mill Providence, R. I., a 90-gallon Cross oil filte making the fourth order placed with th concern; 1 20-inch exhaust head to the Cra Co., Chicago, and one of the same size to large power house at San Jose, Cal.; 1 lar Cross oil filter to the United States Coal Coke Co., for use in its mines in West Vi ginia.

On Jan. 9, Mr. Henry S. Manning sold Mr. C. A. Moore, his entire interest in th firm of Manning, Maxwell & Moore, togeth with his interest in the various manufactu ing concerns, viz.: The Ashcroft Mfg. Co Consolidated Safety Valve Co., Hayden Derby Mfg. Co., and Hancock Inspirator C There will be no change in the name or cha acter of the firm of Manning, Maxwell Moore, and its business in the future w be conducted by Mr. Moore and the men wh have been associated with him. In 1873 th firm of H. S. Manning Co. was started, whic was succeeded by the firm of Manning Ma well & Moore, in 1881. The growth of th business has been steady and constant an the firm now has branch offices in Chicag Cleveland, St. Louis, Pittsburg, Boston an Philadelphia. Various manufacturing inte ests have been acquired, so that to-day th firm is interested in the Ashcroft Mfg. Co manufacturing steam gauges, indicators, pip fitting tools, etc., the Consolidated Safet Valve Co., manufacturing safety valves; th Hayden & Derby Mfg. Co., manufacutrin Metropolitan injectors and ejectors; the Ha cock Inspirator Co., manufacturing Hanco inspirators and valves of various kinds; th Shaw Electric Crane Co., manufacturing ele tric traveling cranes. The reason of Mr. Ma ning's retiring from the firm of Mannin Maxwell & Moore is due to his desire to reti from business and be relieved of busine cares and problems.

The Johnson corrugated steel bars used the construction of reinforced concrete work were awarded a gold medal by the superio jury of the Louisiana Purchase Expositio The award was issued to the St. Louis E panded Metal Fireproofing Co., general Unite States agents for the bars.

Three gold medals have been awarded the F. W. Braun Co., Los Angeles, for i apparatus for assayers, metallurgists an chemists. The exhibit of the company i cluded the Cary hydrocarbon burner, the Ma vel crude oil burner, the Braun gas furnac the Cary furnace, the Braun cupel machin a complete line of ore crushing and pulve izing machines and the Braun ore sampler.

On Jan. 6 the city of Pittsburg, through i Director of Public Works, E. M. Bigelo awarded a contract for 5,000 water meter ranging in size from ⅝ to 6 in. inclusive, the Pittsburg Meter Co., of East Pittsbur Pa. This large order will be filled with th Keystone meter. It is the intention of th city of Pittsburg to meter every water co sumer in the near future, which will requi in the neighborhood of 75,000 meters, so th the contract which has just been placed reall represents but a small portion of the city prospective purchases of meters. This initi ract represents an outlay of $50,000 or 000.

he Baltimore Bridge Co., 128 Broadway, Y., recently received a contract from the :on Aqueduct Commission, New York, for 00-ft., 375-ton arch span highway bridge the spillway of the new Croton dam. It has a contract for about 200 tons of er and other structural steel work in the th Ferry station of the New York Rapid nsit R. R. Other work in the shops incles plate girder spans for the New York, ario & Western Ry., about 1,120,000 lb. plate girder and riveted truss bridges to nplete an order for Central America which been partly shipped; a long plate girder hway span for the American Pipe Manuturing Co., and miscellaneous beam, column l girder work, and other structural mates for buildings and roofs in Baltimore and ewhere. It has completed repair and restruction work for the Boston & Maine R. on a freight bridge over the Charles ver and on the Chelsea viaduct, Boston, d on main line bridges for the New York ntral R. R. Recent shipments include a tice girder highway drawbridge over Indian ver, at Norfolk, Va., and a steel frame gar house for Cuba.

The Thomson Meter Co., Brooklyn, sold ,068 meters in 1904.

The Hogeland-Barrett Mfg. Co., Lemcke ldg., Indianapolis, has been organized to manufacture a check valve invented by the first assistant chief of the fire department of that city. This valve is used on service mains where a domestic pressure of 30 to 40 lb. only is desired, although 100 lb. or more are carried in the street mains for fire protectors.

The Fosburgh Co. has been organized with $200,000 capital to carry on the contracting business of R. L. Fosburgh & Sons. Associated with the old members of the firm will be J. R. Bickford, who, as the firm's superintendent, has been in charge of the concrete-steel buildings of the United Shoe Machinery Co. at Beverly; Henry Cummings, Jr., formerly with Norcross Bros. and the American Bridge Co., and Joseph Gascoigne, formerly with Norcross Bros. The company's offices will be at 6 Beacon St., Boston.

The Minneapolis Steel & Machinery Co., Minneapolis, Minn., has issued a 70-page catalogue of the Twin City Corliss engine. It gives a detailed illustrated description of the parts of this engine that have special features, and illustrates different types and installations that have been made. Steam pumps, air compressors, condensors and transmission machinery are manufactured in the works, and a department is devoted to the design and construction of steel bridges and structural iron. A foundry in which a specialty of semi-steel castings, made after the McDowell formulas, is also a part of the plant.

PERSONAL NOTES.

The members of the engineering staff of the Rapid Transit Subway Construction Co. entertained a number of guests on the evening of Jan. 10, at a dinner given in honor of Chief Engineer S. L. F. Deyo, of that company. During the evening Mr. Deyo was presented with a large gold-lined silver punch bowl by the staff. The bowl was designed and made by Black, Starr & Frost, New York, and is of unusually handsome and artistic appearance. It is about 20 in. in height above the base on which it rests and has its exterior surface decorated with six large panels, on five of which are various engravings emblematical of the great work with which Mr. Deyo has been connected. On the other panel is the inscription: "To Solomon LeFevre Deyo, from His Engineering Associates of the Rapid Transit Subway Construction Co., as a Token of Their Esteem. New York, January 10, 1905." Above this are engraved a transit and level. A view of the power house of the subway division of the Interborough Rapid Transit Co. is shown on a second panel and over it is placed an engraving of one of the 11,000-h.p. generating units in that building. The city hall loop station is shown with a kiosk arranged on a smaller panel above it. A cross section of the East River tubes, with a construction view in the Fort George tunnel over it; the Harlem River tunnel, and above it the Manhattan Valley viaduct; and a section through the Twenty-third street station, accompanied in the smaller panel above it by a view of one of the steel cars used in the subway service, occupy, respectively, the three remaining large panels. These views show quite clearly the subjects from which they were taken, and although they are placed on the curved sides of the bowl the resulting distortion was so carefully overcome in the design that the details are unusually plain and proportionate. The handles of the bowl are made by a clever combination of reproductions of the three-strand cables, and the 100-lb. rails used in the subway construction, together with car wheels having Mercury wings attached. These are arranged as shown in the accompanying cut, one handle between each two of the large panels. The speech of presentation was made by Gen. H. T. Douglas, principal assistant engineer of the Rapid Transit Subway Construction Co., who paid a fitting tribute to Mr. Deyo and the manner in which he has conducted the great constructive difficulties presented in building the underground road. Mr. Deyo was warmly applauded when he arose to respond. Following his speech were speeches by Mr. August Belmont, president of the company; Charles F. Evans, the original secretary of the company; Contractor John B. McDonald, Vice-President E. P. Bryan, and General Manager Frank Hedley, of the Interborough Rapid Transit Co.; Mr. Theodore H. Paschke, of the engineering corps, and Mr. G. E. Thomas, superintendent of the main power house of that company. In addition to those who spoke, F. S. Curtis, G. S. Baxter, H. Fisher, J. F. Buck, Frederick Evans, John Van Horne, Henry T. Douglas, Geo. Gibbs, W. C. Merryman, J. Burns, F. Leffingwell, P. Litchfield, G. G. Raymond, W. C. Boucher, A. S. Berquist, R. S. Fowler, H. N. Latey, F. R. Slater and a few of the wives of the members of the party were guests of the staff.

Mr. Francis P. Cobb has been appointed city engineer of Chicopee, Mass.

Mr. A. K. Crowell has been re-elected city engineer of Taunton, Mass.

Mr. Charles N. Wood has been elected city engineer of Norwalk, Conn.

Mr. Edward J. Johnson has been appointed city engineer at Nashua, N. H.

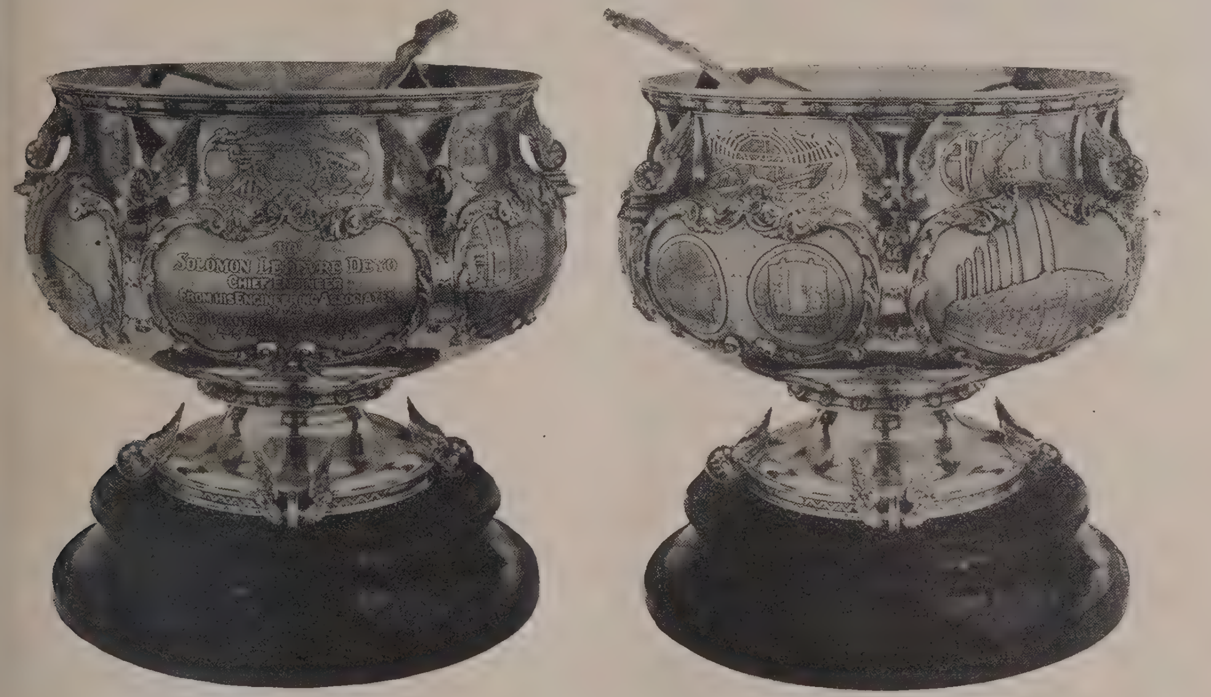
Mr. Joseph H. Young has been appointed city engineer of Fulton, N. Y.

Mr. W. H. Luster, Jr., has been re-elected city engineer of Elizabeth, N. J.

Mr. W. H. Lawton has been reappointed city engineer of Newport, R. I.

Mr. James L. Tighe has been reappointed city engineer of Holyoke, Mass.

Mr. Charles R. Felton has been re-elected city engineer of Brockton, Mass.



PUNCH BOWL PRESENTED TO S. L. F. DEYO, CHIEF ENGINEER, RAPID TRANSIT SUBWAY CONSTRUCTION CO.

Mr. Winslow L. Webber has been re-elected city engineer of Gloucester, Mass.

Mr. Clarence A. Fowler, of Poughkeepsie, has been appointed engineer of Dutchess County, N. Y.

Mr. Philip D. Borden has been nominated for the office of city engineer of Fall River, Mass., by the mayor.

Mr. Henry Goldmark, Montreal, Canada, has recently been elected to membership in the Institution of Civil Engineers, London.

Mr. F. A. Deckert has been appointed master mechanic of the Riverside shops of the Louisville & Nashville R. R. at Knoxville.

Mr. F. J. Allen, roadmaster of the Burlington system at Aurora, Ill., has been promoted to the rank of engineer of maintenance of way.

Mr. Frederick A. McClure and Harrison P. Eddy have been re-elected, respectively, city engineer and superintendent of sewers of Worcester, Mass.

Mr. J. E. Murphy, engineer of the Galesburg division of the Burlington System, has been appointed engineer of maintenance of way of that division.

Mr. Julius E. Willoughby has been appointed chief engineer of the Atlanta, Knoxville & Northern Ry., succeeding Mr. J. H. Peyton, who has become locating engineer of the Louisville & Nashville R. R.

Mr. Webster Gazley, assistant engineer of the Louisville Water Co., has resigned to become president of the National Construction Co., recently organized in Louisville, Ky., to do a general concrete construction business.

Mr. William P. Richards has been appointed surveyor of the District of Columbia, succeeding the late Henry B. Looker. Mr. Richards is a graduate of Lehigh University and has been connected with government engineering work for a number of years.

Mr. W. G. Potter has retired from the position of assistant city engineer of Greensboro, N. C., and has opened an office for general engineering practice in that city. He desires publications from firms handling water works and sewerage constructing materials.

Mr. Arthur Pew, of Hawkinsville, Ga., who was severely hurt in an accident last winter, has only recently recovered from his injuries. He has opened an office in the Temple Court Bldg., Atlanta, and will resume his practice in railway and municipal engineeering.

Mr. C. M. Wilkes, mechanical engineer with D. H. Burnham & Co., died suddenly in Philadelphia, on Jan. 7. He designed the mechanical plants in many of the largest buildings in the country, and a number of his installations have been described in this journal.

Mr. E. L. Corthell sailed Jan. 7 on the steamship Philadelphia, for France. From France he goes to Lisbon, Portugal, and will sail from there for Buenos Ayres, Argentine. He expects to return to this country in about two months, but will make a trip to Brazil before coming back.

Mr. Ross F. Tucker, president of Tucker & Vinton, Inc., New York, has been appointed as consulting engineer with Mr. Goodrich, chief engineer, and Mr. Higginson, architect, for the construction, in reinforced concrete, of the model factory building for the Bush Terminal Co., in South Brooklyn.

Mr. John Anderson has resigned the duties of superintendent of the water department of Binghamton, N. Y., but will retain the position of secretary of the department. His successor as superintendent will be Mr. Moses Stoppard, who has been one of the water commissioners for about ten years.

Mr. D. W. Pike has resigned the office of city engineer of Kansas City, Mo., to devote his entire time to the business of the engineering firm of Pike & Tuttle. He will be succeeded on Feb. 1 by Mr. Edgar A. Harper, who has been connected with the city engineering department for fifteen years.

The Electric Controller & Supply Co., Cleveland, Ohio, has placed Mr. Geo. Magalhaes in charge of its eastern office at 136 Liberty St., New York City. Mr. Magelhaes is a graduate of the Columbia University and has been connected with the engineering department of the company for some time.

Mr. F. A. Delano, who for three years has been general manager of the lines east of the Missouri of the Chicago, Burlington & Quincy Ry., has retired from that position. His duties will be assumed by Daniel Willard, second vice-president of the road. Mr. Delano, after a trip abroad, will return to Chicago.

Messrs. J. M. Lyle and J. L. Faucett have formed a partnership under the firm name of Lyle-Faucett Engineering Co., Chattanooga, Tenn. They will do a general consulting and erecting business, and are managers of the Chattanooga office of the Lane & Bodley Co., Cincinnati, Ohio, and The Brownell Co., Dayton, Ohio.

Mr. R. W. Pratt, engineer of the Ohio State Board of Health, will read a paper on "Filtration of Public Water Supplies," and Mr. George A. Johnson, engineer in charge, will read a paper on "The Sewage Testing Station at Columbus, Ohio," before the fifteenth annual meeting of the State and local boards of health of Ohio, at Columbus, Jan. 27-28, 1905.

At the annual meeting of the Engineers' Society of Western Pennsylvania, this weeek, the following officers were elected: President, Samuel Diescher; vice-president, S. M. Kintner; directors, G. T. Barnsley and Morris Knowles; secretary, F. V. McMullen; treasurer, A. E. Frost, this being his twenty-fourth term in the office. The membership at the close of the year was 927 and the average attendance at meetings 89.

Mr. Eugene Klapp, until recently division engineer of the New York Rapid Transit Commission, in charge of the elevated roads connected with the rapid transit subway on Manhattan Island, New York City, has been appointed consulting engineer of the Brooklyn Rapid Transit Co. Mr. Klapp was at one time chief engineer of the South Side Elevated Railroad, in Chicago, and was later manager of the National Construction Co., of New Orleans, La.

Mr. Wendell P. Brown, who has been engineer for the King Bridge Co., at its main office at Cleveland, Ohio, for several years, has been transferred to the company's New York office, at 277 Broadway, succeeding Mr. Geo. E. Gifford as Eastern representative. Mr. Gifford, who has been the company's representative in New York City for the past ten years, has resigned to accept the position of Contracting Engineer with Milliken Bros., 11 Broadway, New York.

Mr. E. F. Van Hoesen will succeed Mr. Wm. Pierson Judson as deputy State engineer of New York on Feb. 1. He was graduated from the Rensselaer Polytechnic Institute in 1878, and from 1879 to 1886 was connected with the engineering corps of the Pennsylvania R. R. on location and construction. From 1886 to the present time he has been with the New York Central Lines, for the last ten years in charge of construction on the western district, including the heavy work for eliminating grade crossings in Buffalo.

At a meeting on Jan. 7, of the Conference Committee on the United Engineering Building. Mr. Alfred R. Wolff was unanimously appointed consulting engineer for the heating and ventilation of both the United Engineering Building and the Engineers' Club, to be erected at 39th and 40th Sts., under the Carnegie gift of $1,500,000. Mr. C. O. Mailloux was selected as the consulting electrical engineer for the United Engineering Building, and Bates & Neilson were selected as consulting electrical engineers for the Engineers' Club. All of these gentlemen are prominently identified with the organizations that will occupy the buildings in question.

In the death on Jan. 4 of Henry V. Poor, founder of Poor's Manual, American technical journalism lost its oldest editor. Soon after his graduation from Bowdoin College about seventy years ago, he came to New York and eventually found employment on the "American Railway Journal" a publication started about 1831. Railway affairs in those days were in their infancy, and the numbers of this journal consisted mainly of a few extracts from reports on projected lines and a large amount of miscellaneous prose and verse prepared by a free use of scissors and paste brush. The paper barely existed, and at one time its publisher's announcement related mainly to an account of his hotel in Philadelphia, where he was prepared to give entertainment to man and beast. Mr. Poor's work on the paper was of the clean-cut analytical nature which made his subsequent private undertaking, the annual manual bearing his name, such a valuable publication.

The Widell-Finley Co., engineers and contractors, has been incorporated for carrying on a general engineering and contracting business and succeeds to the contracting business of G. Widell, of Mankato, Minnesota. They will make a specialty of all classes of foundation and substructure work, masonry and concrete structures, and the erection of steel and wooden bridges. The members of the company have had a long experience in this line of work and are well equipped to undertake any construction work of this nature. Mr. G. Widell has been a contractor for high-class masonry and concrete work. He is the owner of well developed quarries at Mankato, Minn., furnishing the stone used in numerous important structures in the northwest. Mr. W. H. Finley has been connected with the engineering department of the Chicago & North-Western Ry. for the past thirteen years, filling the position of engineer of bridges during eight years of that time and as principal assistant engineer for the past five years. During that time he has had charge of the designing and construction in the field of various important pieces of work. Mr. W. A. Hazard has had a long experience in construction work, having been connected with the engineering department of the Chicago & North-Western Ry. for two years as assistant engineer in charge of construction, and for the past six years as engineer and superintendent of construction for Mr. G. Widell. The company has opened offices at 655-656 Monadnock Block, Chicago, and in Mankato, Minnesota. Mr. Finley and Mr. Hazard are in charge of the Chicago office.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

ARRANGED ALPHABETICALLY BY STATES UNDER EACH DEPARTMENT

WATER.

Indio, Cal.—See "Power Plants, Gas and Electricity."

Oakland, Cal.—At a meeting of City Council, Dec. 27, the special Bd. of Engrs. on water supply, made a report recommending the plan proposed by the Bay Cities Water Co. to provide a water supply system for the City of Oakland, whose capacity would be 20,000,000 gals. of potable water per day.

Ft. Logan, Colo.—Bids are wanted Jan. 28 for furnishing material and installing an 80-h.-p. return tubular boiler and a 27,000-gal. steel receiving water tank at this post. Col. C. A. H. McCauley, Ch. Q. M.

New London, Conn.—Wm. H. Johnson, general inspector of the Natl. Bd. of Fire Underwriters, is reported to have recommended the laying of a 24-in. water main and the replacing of all the mains and pipes under 8-in. with 8-in pipe. To connect Lake Konomoc with New London by a 24-in. pipe, which is a distance of about 5 miles, would cost about $125,000, and the laying of 156,213 ft. of 8-in. pipe would cost about $93,728.

Bridgeport, Conn.—It is stated that the Bridgeport Hydraulic Co. will make extensive improvements to its system, including the laying of nearly 6½ miles of pipe from 16 to 24-in. and a new reservoir.

Danbury, Conn.—Chas. B. Mason, Supt. Water Wks., writes that it is proposed to construct new reservoir, but nothing definite has yet been done.

Branford, Conn.—The Branford Lighting & Water Co. is reported to be considering the extending of its water system, at a cost of $30,000. F. H. Golding, Supt., Branford.

Jacksonville, Fla.—Bids will be received Feb. 6 by the Trus. for Water Wks. and Improv. Bonds, for furnishing a single acting triplex stuff pump, geared to a 3 phase 210 volt induction motor; pumps to deliver at least 490 gal. per minute against a head of 30 ft., at a speed not exceeding 40 revolutions per minute; bids will also be received on same date for sinking a 10 in. artesian well to depth of 980 ft. For further information apply to R. N. Ellis, Supt.

Lakeland, Ky.—The Comrs. of the Central Asylum for Insane are reported to be considering plans for a reservoir at Lakeland, with a capacity of 50,000,000 gal.

Owensboro, Ky.—The lowest combination bid opened by the City Council on Jan. 2 for the construction of water works, is stated to have been submitted by John Trapp, of Newport, Ky., for $103,188. This does not include pipe and joints.

New Orleans, La.—F. S. Shields, Secy. Sewerage and Water Bd., writes that, owing to some technical defect, it has been necessary to discontinue the advertisement for the construction of 65 miles of sewers and appurtenances and the furnishing and laying of 15 miles of c. i. water mains and appurtenances and 4,000 ft. of railroad tracks, bids for which were to have been opened on Jan. 31.

Auburn, Me.—Bids are wanted by the Water Comrs. (F. E. Bisbee, Supt.) for 490 tons of 20-in. pipe. The department will do the pipe-laying.

Revere, Mass.—The citizens on Dec. 29 voted to issue $400,000 bonds for the purchase of the plant of the Revere Water Co.

Detroit, Mich.—Reports state that bids will be received Jan. 24 by Darius D. Thorp for $150,000 water bonds.

St. Paul, Minn.—Bids will be received Jan. 20 by the Bd. Water Comrs. for furnishing Water Bd. with 4 to 16 in. water gates; for furnishing said city with 1,000 ft. 4 in. c. i. water pipe, 20,000 lin. ft. 6 in. with privilege of 10,000 ft. additional, 2,000 ft. 8 in. with privilege of 1,000 ft. additional, 8,000 ft. 12 in. with privilege of 2,000 ft. additional and 2,000 ft. 16 in. with privilege of 1,000 ft. additional; also with hydrants; for furnishing and delivering said Water Bd. certain c. i. special castings; also furnishing and delivering during year 1905 f.o.b. cars 1,500 stop boxes, with privilege of 250 additional, and all valve boxes from 4 to 16 in. that may be required. John Caulfield, Secy.

Thief River Falls, Minn.—Lars Backe, City Clk., writes that it is proposed to construct water works and a sewerage system, to cost from $30,000 to $40,000. No engineer selected as yet.

Houston, Miss.—See "Power Plants, Gas and Electricity."

Windsor, Mo.—The citizens voted on Dec. 29 to issue $20,000 bonds for water works, and Burns & McDonnell, Dwight Bldg., Kansas City, Mo., were engaged to prepare plans and specifications. Water Supply will be secured from a deep well. W. G. Davis, City Clk.

St. Louis, Mo.—The Bd. of Pub. Improv. has approved the bill providing for an appropriation of $35,000 to install 2 boilers with pipe and fittings for the low-service station at the Chain of Rocks.

**Washington, Ga.*—The following are the bids opened on Jan. 5 by J. R. Dyson, Mayor, for improving the water supply (Engr., N. Wilson Davis, Harrisburg, Va): (*a*) Van D. Hitesmith, Knoxville, Tenn.; (*b*) Walton & Wagner, Rome, Ga.; (*c*) Phila. Wrecking & Contr. Co., Baltimore, Md., (awarded contract); (*d*) Lane Bros. Co., Ermont, Va.:

	a.	*b.*	**c.*	*d.*
4,800 lin. ft. 15-in. terra cotta pipe....	$0.61½	$0.5937	$0.55	$0.65
10 cu. yd. concrete intake dam	14.50	10.50	15.00	20.00
3,200 " earth excavation (reservoir)	.25	.28	.24	.25
2,200 sq. yd. paving (reservoir)	.66⅓	.1363	.60	1.46
500 cu. yd. concrete (reservoir).......	5.60	6.00	5.00	7.50
45,000 brick laid (reservoir)	12.00	11.11	12.00	14.00
50 cu. yd. masonry	7.00	10.00	5.50	7.00
1 pump station	1,410	2,500	2,500	2,800
1 pump	1,050	850	1,000	1,000
2 boilers	1,520	1,625	1,800	2,200
130 cu. yd. masonry (stand-pipe)......	6.00	5.38	5.00	6.00
1 stand-pipe	6,000	5,382	5,300	5,400
10,400 ft. 8-in. cast-iron pipe...........	.73	.81	.90	.79
20 cu. yd. rock excavation.	1.50	3.00	4.00	3.00
Totals	$28,515	$28,602	$29,653	$33,441

Augusta, Ga.—Mayor Richard E. Allen, in his message to City Council, recommends the construction of a duplicate main from the filter plant to the city, the paving of Jackson St. from Broad to Walker St., and the erection of a new city hall.

Potacello, Idaho.—It is stated that bids will be received Mar. 31, by the Pocatello Water Co., for furnishing 500 meters.

Chrisman, Ill.—J. M. Hedrick, City Clk., writes that bids will be received Feb. 7 for the construction of water works. Engineer, Geo. C. Morgan, 169 Jackson Boule., Chicago.

Ashton, Ill.—Dr. H. A. Bremmer is reported to have secured a franchise for water works.

Chicago, Ill.—The lowest bid opened on Jan. 3, by the Comr. of Pub. Wks., for the foundation for a 25,000,000 gal, pump at the Chicago Ave. pumping station, is stated to have been submitted by Wm. E. McCarthy, for $19,800.

Elgin, Ill.—Water bonds to the amount of $14,000 were sold on Jan. 3.

South Bend, Ind.—A. J. Hammond, City Engr., writes that it is proposed to purchase a pumping engine, at a cost of $10,000 to $15,000.

Bids will be received by the Bd. of Pub. Wks. on Feb. 8 for 750 to 1,400 tons c. i. water pipe.

Lindsborg, Kan.—Bids are wanted Jan. 21 for furnishing and delivering f.o.b. cars about 200 tons 4, 6 and 8 in. c. i. water pipe and about 3 tons special castings. N. J. Thorstenberg, Mayor.

Wichita, Kan.—J. L. Leland, City Clk., writes that it is not proposed at this time to purchase any new machinery for the water works.

Hopkinsville, Ky.—The Hopkinsville Water Co. is stated to have purchased property east of this city, on which it is proposed to construct a reservoir with a capacity of 200,000,000 gal.

Chester, Mont.—Press reports state that the Great Northern R. R. Co. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) will construct 3 reservoirs, one to be located at Gilford, one at Chester and one at Concord.

North Platte, Neb.—Wm. Yost, City Clk., writes that it was voted on Jan. 3 to issue $60,000 bonds for water works and $30,000 for a sewerage system.

Binghamton, N. Y.—Moses Stoppard, Supt. Water Wks., is reported to be plannng improvements to the water works, to be made in the spring.

Brooklyn, N. Y.—Bids will be received F 1 (readvertisement) by John T. Oakley, Com Water Supply, Gas and Electricity, N. City, for furnishing and delivering 700 fo nozzle post hydrants and 40 two nozzle f boat connection hydrants for high pressu fire service mains.

Bids will be received Jan. 25 by John Oakley, Comr. Water Supply, Gas and El tricity, for N. Y. City, for furnishing and livering brass composition castings.

New York, N. Y.—Bids will be receiv Jan. 25 by John T. Oakley, Comr. Water Su ply, Gas and Electricity, for furnishing a delivering, tapping cocks, tapping cock box twist and plug drills and hydrant nozzl waste cocks, caps and chains, handles, scree and bridges, in Boro. Manhattan and Bron

Utica, N. Y.—Local press reports state th the Consolidated Water Co. is to construct pipe line 24-in. diam. and construct an inta on West Canada Creek. About 9,500 tons c. i. pipe will be used, and of this amount t Utica Pipe Fdy. Co. will furnish 2,500 to Clifford Lewis, Jr., is engineer of constr tion.

Newark, N. Y.—The citizens are report to have voted Jan. 5 to issue $50,000 bon to purchase the present water works and $1 000 to improve and extend the system.

Lockport, N. Y.—The citizens voted on Ja 5 in favor of the proposition of the Niaga Lockport & Ontario Power Co. to supply Lo port with water from the Niagara River means of a power canal to be built to t city. The city will enter into contract w the company within 30 days, bonding its for $300,000, for a plant to pump the wat from the proposed power canal.

Asheville, N. C.—City Engr. Lee estima the cost of constructing a 4,000,000 gal. r ervoir at $36,085, and one of 6,000,000 g at $45,520.

Greensboro, N. C.—It is reported that t Southern Ry. Co. (E. H. Coapman, Div. Sup Greensboro) will instal water works Greensboro.

Oxford, N. C.—See "Power Plants, Gas a Electricity."

Mingo, O.—See "Power Plants, Gas a Electricty."

**Canton, O.*—Contracts for water wor machinery (bids opened Dec. 19) are stated have been awarded as follows: Pumping e gine, of 157,000,000 ft. lb. duty, weight 3 tons and capacity 12,000,000 gal., to t Wm. Tod Co., of Youngstown, for $44,60 3 boilers to Wickes Bros., of Saginaw, Mic for $7,128; 3 stokers to the Westinghou Machine Co., of Pittsburg, for $2,650, a valves for the machinery to the Michig Brass & Iron Wks., for $1,580.

Lima, O.—Bonds to the amount of $25,0 are reported sold to be used to complete t reservoir.

Lakewood, O.—Bids will be received Ja 21 by the Bd. Trus. of Pub. Affairs (Hen W. Burton, Clk.) for laying water main Warren Road.

Tillamook, Ore.—Thos. Coates, City Reco er, writes that water works bonds to t amount of $45,000 were sold on Dec. 29. Bi for construction of water works will be ceived on Feb. 23. Length of main pipe li 5.8 miles of 10-in. pipe. Distribution syste about 3½ miles of 8, 6, 4 and 3-in. pi principally 6 and 4-in. Estimated cost construction, $42,000. Engineer, W. B. Chas Worcester Bldg., Portland.

Connellsville, Pa.—The Mountain Wat Supply Co. is reported to have absorbed f smaller concerns, and is actively at work the preliminaries for damming Indian Cree a mile from here, and the construction of reservoir to supply Pittsburg and points over Western Pennsylvania. S. M. James, Connellsville, has been engaged to do the e gineering work, and Aug. Styckel, of Mill Ru is aiding in securing right of way.

Hollidaysburg, Pa.—The Frankstown Tow ship Water Co., of Hollidaysburg, is report incorporated, with a capital of $5,000.

Brooklyn, N. Y.—The following are the bids opened on Jan. 6 by John T. Oakley, Com Water Supply, Gas & Electricity, for furnishing, delivering and laying high-pressure fire se vice mains and appurtenances in Brooklyn Boro., including the furnishing and laying of 1,0 stop-cocks and 60 ½-in. corporation cocks; (*a*) John J. Cashman, 44 Court Sq., Brookly (*b*) Excavation & Constr. Co., 100 B'way, New York; (*c*) Wm. Bradley, 86th St. and B'wa New York; (*d*) T. A. Gillespie, 71 B'way, New York; (*e*) Borough Constr. Co., 64th S Brooklyn:

	a.	*b.*	*c.*	*d.*	*e.*
11,700 tons straight c.-i. pipe...........	$29.00	$29.00	$35.00	$31.00	$32.
875 tons special castings	98.00	100.00	100.00	105.00	84.
115,000 lbs. steel castings	.10	.10	.08	.10	.
Laying delivery pipe:					
27,300 lin. ft. 20-in.	1.30	1.50	1.25	1.20	1.
34,500 " 16-in.	1.00	1.25	1.05	1.10	.
54,500 " 12-in.	.85	1.00	.85	1.00	.
7,400 " 8-in.	.73	.90	.75	.65	.
Laying suction pipe:					
100 lin. ft. 20-in.	5.00	2.00	5.00	2.00	1.
100 " 16-in.	4.00	2.00	4.00	1.50	1.
11,500 cu. yd. extra excavation..........	.75	2.00	2.00	1.75	
875,000 lbs. c.-i. gate boxes, etc..........	.03	.03	.03	.03¼	.
725 hydrants, to haul and set........	10.00	10.00	10.00	12.50	10.
Relaying pavement:					
8,200 sq. yd. cobble	.20	.40	.25	.35	
16,500 " block	.30	.50	.50	.40	
11,000 " block on concrete fdatn..	1.75	3.00	1.50	1.00	1.
New pavement on concrete foundation:					
11,600 sq. yd. asphalt	3.00	4.00	3.50	3.00	3.
220 " brick	3.00	3.50	3.50	4.00	4.
570 " wooden	3.00	4.00	3.50	4.00	4.
1,550 lin. ft. bluestone curb	.15	.10	.20	.25	
7,800 sq. ft. bluestone flag..............	.05	.05	.10	.15	
6,960 " cement sidewalk...........	.20	.20	.20	.20	
300 cu. yd. concrete	10.00	10.00	8.00	8.50	8
900 " brick work	12.00	15.00	12.00	13.50	12
30 M. ft. lumber	25.00	20.00	30.00	30.00	25
15,000 lbs. steel shapes.................	.05	.06	.04	.05	
460 cu. yd. rock excavation	3.75	5.00	2.50	5.00	2
Totals	$792,601	$916,072	$867,717	$843,905	$795,

artanburg, S. C.—W. F. McCormick, of rlotte, N. C., is reported to be preparing s and estimates for an auxiliary plant be added to the present plant of the er Co. John B. Cleveland, Pres.

reen River, Utah.—Frank Cook, of Green er, has made application in the State r.'s Office to appropriate 975 cu. ft. per nd of the water flowing in Green River ch is to be used to develop power for ping water for irrigation purposes. He ects to use eight 36-in. turbine wheels un- a low head. They will be connected di- ly to the pump shafts.

alt Lake City, Utah.—The citizens voted Jan. 3 to issue $850,000 bonds to increase water supply, and $150,000 for sewers.

sland Pond, Vt.—The citizens are stated have voted in favor of municipal owner- of the water works. The Selectmen will chase the local water works if possible; if , a new system will be installed. M. B. id, J. Thurston and B. W. Farmer, Select- n, have the matter in charge.

Aberdeen, Wash.—The Nephine Salvage & ecking Co., of Seattle, is stated to have ured the contract for laying the big water in across Chehallis River, for $7,820.

Rock River, Wyo.—Josephine A. Taylor, of ck River, is stated to have filed with the ate Engr. application for permission to con- uct a canal to take water from Rock River d reclaim 35,600 acres of land in the west- portion of Albany County.

Belleville, Ont.—The citizens are stated to ve voted Jan. 2 to issue $10,000 bonds to prove the water works.

Stratford, Ont.—The citizens are stated to ve voted Jan. 2 to expend $50,000 for ex- nsion and enlargement of the water works, d $7,000 to complete the sewage disposal ant.

Cornwall, Ont.—At the election Jan. 2 the tizens are reported to have voted to expend ,000 to extend the water works.

Brantford, Ont.—The citizens are reported have voted Jan. 2 to grant the Water omrs. $50,000 to improve the water works.

Guelph, Ont.—The by-law providing for 7,000 to install new filter and improve the ater works is reported to have carried at e election Jan. 2.

Toronto, Ont.—The City Engineer's Dept. now expending $1,000,000 in improvements the water works and $700,000 in the con- truction of an auxiliary system of pumping ngines and fire mains for fire purposes.

EWERAGE AND SEWAGE DISPOSAL.

San Francisco, Cal.—Local press reports tate that bids will be received on Mar. 6 for 2,573,800 bonds to be used as follows: Hos- ital, $250,000; sewer, $724,800; school, $1,- 77,600; street improvements, $243,000; ounty jail and additions to the Hall of Justice, $278,400.

Waterbury, Conn.—The question of constructing a sewage disposal plant is reported nder consideration here. Contracts will robably be let in the spring. Robt. A. Cairns, City Engr.

**Hartford, Conn.*—Edwin Dwight Graves, Ch. Engr. Comrs. River, Bridge and Highway Dist., Room 52, Aetna Life Bldg., writes that the contract for constructing a drainage system in the railroad yards north of Morgan St. (bids opened Dec. 31) has been awarded to Chas. H. Slocomb, of Hartford, for $3,175.

Washington, D. C.—Bids will be received on Jan. 30 for constructing a portion of the sewage disposal system, trunk sewers and connections, including sewage conduits and twin sewers in the District of Columbia, as advertised in The Engineering Record.

Bids are wanted Jan. 19 for furnishing repressed vitrified sewer invert bricks, as advertised in The Engineering Record.

Bids are wanted Feb. 6 for furnishing and erecting coal and ash-handling machinery for the sewerage pumping station, as advertised in The Engineering Record.

Palatka, Fla.—Bids will be received by the Bd. of Bond Trus. on Feb. 1 for constructing a sanitary sewerage system, as advertised in The Engineering Record.

Dublin, Ga.—Bonds to the amount of 18,000 have been sold for sewers, and Arthur Pew, Temple Court Bldg., Atlanta, has been engaged to prepare plans.

Atlanta, Ga.—Local press reports state that during the coming year about $106,000 will be expended for new sewers, including the completion of the Mineral Springs sewer and its connections; the building of a sewer through Grant Park to the city limits; the extension of the sewer which drains the 3d Ward and now stops at Pearl St., and also the extension of 2 lateral sewers in connection with it. R. M. Clayton, City Engr..

New Albany, Ind.—Press reports state that the following are the bids opened on Jan. 2 by the City Council for the construction of a sewerage system: M. A. Talbot & Co., Logansport, Ind., $226,000; Geo. O. Tenny, Spartanburg, S. C., $238,000; L. A. Marshall & Co., Indianapolis, $236,710; Irwin Bros., New Orleans, $238,543; Foulkes, Forbes & Co., Terre Haute, $240,000; Roberts & Co., Terre Haute, $236,049; Burch, Govern & Co., Muncie, $249,000; P. J. McNerney, Brownstown, $207,310.21; Seibert & Smith, Indianapolis, $237,500; W. R. Hines & Co., Franklin, $246,372, and Jas. Healey, Chicago, Ill., $288,376.

Perry, Ia.—M. A. Earl, of Chicago, Ill., is stated to be preparing plans, specifications, etc., for a sewerage system for Perry.

Des Moines, Ia.—Aldermen Myerly and Sutherland are stated to have filed with the City Clerk, plans for a 42-in. brick sewer from 21st and High Sts., through the west end of Des Moines.

**Davenport, Ia.*—Local press reports state that the following are the bids opened on Jan. 2 for the construction of 17,600 ft. of sewer in Northwest Davenport: Davenport Constr. Co., $4.10 per lin. ft.; People's Constr. Co., $3.83, total, $67,408 (awarded contract); and the McCarthy Improv. Co., a total bid of $77,495.

Topeka, Kan.—Plans and estimates will be submitted by Jas. F. McCabe, City Engr., to the Mayor and Council on Jan. 16 for brick and pipe sewers; probable cost of work, $85,000. Contracts will probably be let on Feb. 6.

Lexington, Ky.—City Engr., R. P. O'Neill is reported to have prepared plans and specifications for the construction of three main trunk sewers. They will be of brick, laid on a concrete bed wherever necessary, and the outlets will be circular in form.

New Orleans, La.—See "Water."

Worcester, Mass.—Harrison P. Eddy, Supt. of Sewers, in his annual report, estimates that $113,000 will be required by the Department during the year, of which $30,000 is for sewer construction, $55,000 for sewage purification, and $28,000 for maintenance.

Paw Paw, Mich.—Plans for sewers have been prepared by Geo. S. Pierson, of Kalamazoo. Construction will probably commence in the spring.

Thief River Falls, Minn.—See "Water."

South St. Joseph, Mo.—It is reported that plans are being prepared for the construction of a $75,000 main sewer.

**Jefferson City, Mo.*—J. C. Herring, City Engr., writes that the following are the bids opened on Jan. 4 for constructing sewers in Sewer Dist. No. 11 (City Engineer's Estimate, $8,922): Gruber & Vetter, Jefferson City, $8,364 (awarded contract); T. W. Roberts, Independence, $8,460; H. W. Kolkmeyer & Co., Jefferson City, $8,500; Maquoketa Const. Co., Maquoketa, Ia., $8,835; Rackliffe & Gibson, St. Joseph, $9,926, and Myers Const. Co., St. Louis $9,990. The detail bid of Gruber & Vetter, the successful bidders, is as follows: 9,626 lin. ft. 8-in. pipe, inc. Y's and cement joints, 21 cts.; 20 lamp-holes, $7; 2 flush-tanks (Alameda gravity flusher), $95; 24 manholes, $40; 50 for ea. additional ft. of manhole over 6 ft., $2.50; 10,509 lin. ft. excav. and backfill, under 6 ft. deep, 11 cts.; 1,850 lin. ft. excav. and backfill, 6 ft. or over and under 8 ft., 16 cts.; 10 lin. ft. excav. and backfill, 8 ft. or over and under 10 ft., 40 cts.; 20 lin. ft. excav. and backfill, 10 ft. or over and under 12 ft., 45 cts.; 90 lin. ft. excav. and backfill, 12 ft. or over and under 14 ft., 70 cts.; 140 lin. ft. excav. and backfill, 14 ft. or over and under 16 ft., 80 cts.; 100 cu. yd. riprap, $1.60; 130 cu. yd. concrete masonry (Portland cement 1-3-5), $5.50; 20 cu. yd. solid rock excav. in trench, $3; 100 cu. yd. embankment, 70 cts.; 3,420 lin. ft. 14-in. pipe, inc. Y's and cement joints, 43 cts.; 135 lin. ft. 14-in. iron pipe, inc. lead joints, $4; 450 lin. ft. 15-in. pipe in same trench with 8-in. sewer, 45 cts., and 200 lin. ft. ¾-in. water supply pipe, inc. fixtures, 30 cts.

North Platte, Neb.—See "Water."

Jersey City, N. J.—Bids will be received Jan. 16, by the Bd. Street and Water Comrs., for reconstructing sewer in a portion of Baldwin Ave.; estimate of quantities about 315 lin. ft. 36-in. brick circular sewer, and about 100 cu. yds. rock excav. Geo. T. Bouton, Clk.

**West Orange, N. J.*—Antonio Costa, of Orange, has secured the contract for constructing Sections Nos. 4 and 7 of the sewerage system at $13,899 and $14,887 respectively, and John F. Driscoll, of Orange, for Sect. No. 7 for $13,635 (bids opened Dec. 20).

Ft. Michie, N. Y.—Bids are wanted Feb. 4 for constructing sewer at this post. Address Constructing Q. M., New London, Conn.

Auburn, N. Y.—Plans for sewers and a sewage purification plant for 4th, 5th, 6th and 7th Wards Sewer Dist. are being prepared by Geo. S. Pierson, of Kalamazoo, Mich.

Brighton, N. Y.—Fred K. Wing, of Buffalo, is reported to be making a survey of the village, with a view to submitting plans for a sewerage system; probable cost, $50,000. Election will be held on Jan. 18 to vote on question.

Ballston Spa, N. Y.—Plans are stated to have been completed and presented to the State Bd. of Health for approval for the proposed sewerage system of the village.

Little Falls, N. Y.—Edgar H. Douglas, Mayor, in his annual message to Council recommends that steps be taken toward constructing a separate system of storm sewers, the paving of the business section of city with brick, the building of good macadam streets and the purchase of a stone crusher.

Dayton, O.—Bids will be received Jan. 20, by the Bd. Pub. Service, for constructing sanitary sewers in two portions of Dist. No. 4; one portion to consist of 2,280 lin. ft. 8 and 10-in. pipe sewer, 9 manholes and 1 flush tank, and the other to consist of 9,290 lin. ft. 8 and 10-in. pipe sewer, 21 manholes, 8 flush tanks and 10 lamp holes. Wm. F. Miller, Clk.

Youngstown, O.—F. M. Lillie, City Engr., is reported to have been instructed to prepare estimates for sewering and paving W. Federal St. with Medina block; probable cost of work, $38,000.

Bucyrus, O.—It is reported that the question of improving the sewerage system is under consideration here.

**Cleveland, O.*—The Board of Public Service is stated to have on Dec. 30, approved a subsidiary contract with John Wagner for building a section of the intercepting sewer east of Doan St., for $98,250.

**Cincinnati, O.*—N. Ruebel is stated to have secured the contract for sewers on Western Ave. and Dempsey, Liddell and Grove Sts. (bids opened Dec. 22) for $12,331. John E. Mahoney secured the contract for sewers on Mistletoe St. and Kineon Ave. for $5,717.

Toledo, O.—Bids will be received Jan. 19, by the Bd. Pub. Service, for furnishing material and constructing sewer No. 897. Harry S. Jones, Secy.

**North Braddock, Pa.*—A. C. Stewart, Boro. Engr., writes that John S. Sheekey, of Rankin, secured the contract for constructing pipe sewers in three streets (bids opened Dec. 30) for $6,294.

Esplen, Pa.—An ordinance has passed first reading in Council authorizing the issue of $25,000 bonds for the grading, paving, curbing and sewering of River Ave. from Chartiers Creek to 8th Sts.

Johnson City, Tenn.—A charter has been granted to the Johnson City Sewerage Co., with a capital of $2,500. Incorporators: S. H. Ponder, S. C. Williams, and others.

**Beaumont, Tex.*—Geo. W. Sykes, City Engr., writes that Callaghan & Graham, of Beaumont, has secured the contract for constructing an extension to the sewerage system (bids opened Dec. 17) at the following detailed bid: 2,800 ft. 18-in. standard pipe, $1.95; 900 ft. 27-in. double-strength pipe, $3.92; 870 ft. 36-in. double-strength pipe, $7.34; 1,450 ft. 24-in. standard pipe, $2.66; 112 pieces 18-in. specials (Y's and T's), $1.16 per ft. extra; 58 pieces 24-in. specials (Y's and T's), $2.50 per ft. extra; 36 pieces 27-in. specials (Y's and T's), $3.25 per ft. extra; 35 pieces 36-in. specials (Y's and T's), $8.10 per ft. extra; 60 catch-basins, ea. $70; 20 manholes, ea. $45; brick, per cu. yd., $11.50; concrete, per cu. yd., $9; timber, per M ft., $21; excav., per cu. yd., 60 cts., and emb., per cu. yd., 75 cts.; total, $25,837.

Havana, Cuba.—The House of Representatives of Cuba, at Havana, on Jan. 9, is stated to have passed the bill (previously passed by the Cuban Senate) appropriating $326,000 for the immediate sanitation of Cuban cities.

Lunenburg, N. S.—It is stated that bids will be received Feb. 15, by Geo. H. Love, Town Clk., for constructing sewer system.

Stratford, Ont.—See "Water."

Berlin, Ont.—The citizens are reported to have voted Jan. 2 to issue $65,000 bonds for extending the sewage disposal plant, and to pay certain damage claims in connection with the sewer farm.

BRIDGES.

**Mobile, Ala.*—It is stated that the Wisconsin Bridge & Iron Co., of Milwaukee, has received the contract for constructing bridges and viaducts along the line of Mobile & St. Louis Ry., from Mobile, Ala., to St. Louis, Mo., for about $200,000.

Chicago, Ill.—See "Paving and Roadmaking."

Wabash, Ind.—Bids will be received Feb. 7 by the Bd. Co. Comrs. for constructing a 240 ft. viaduct over Charly Creek, with two 75 ft. arches for waterway, 24 ft. macadam roadway, 1 ft. gutter and 5 ft. walk on 1 side. W. S. Davis, Co. Aud.

Indianapolis, Ind.—It is stated that the contract will soon be let for constructing a bridge over Williams' Creek, to connect Marion and Hamilton Counties.

*M. M. Defrees is stated to have received the contract for constructing a temporary trestle bridge over White River, at Morris St., for $9,000.

Marion County Bridge bonds amounting to $170,000 are reported sold.

Sioux City, Ia.—See "Railroads."

Muscatine, Ia.—Bids are wanted Feb. 7 for furnishing material and constructing steel county bridges during year ending Feb. 4, 1906. A. S. Lawrence, Co. Aud.

Topeka, Kan.—Separate bids will be received Feb. 6 by J. H. Squires, City Clk., for constructing the following 6 bridges; a steel concrete wagon and foot bridge (Melan Arch patent) over Kansas River on Kansas Ave.; 3 steel truss bridges over Shunganunga Creek (1 at south end of Kansas Ave., 1 at 20th and Van Buren Sts., and the other at Chandler St.) and 2 combination bridges, steel and I beams, over Ward's Creek, 1 on Park Ave., the other on Willow Ave.

Shreveport, La.—The Shreveport Bridge & Terminal Co. is reported to be preparing to construct a railway bridge across Red River at Shreveport, La. It will contain a draw span. M. L. Lynch, Ch. Engr., Tyler, Tex.

Gloucester, Mass.—The petition of Mayor and City Solicitor, with accompanying bill, authorizing the Comrs. of Essex County to construct a drawbridge over Gloucester Canal, with draw opening of 40 ft., at expense not exceeding $55,000, was presented to the Legislature on Jan. 5. Winslow L. Webber, City Engr.

Alpena, Mich.—It is stated that a cement bridge will be constructed over the Thunder Bay River near here, at a cost of $12,000, the county to pay one-third of the cost.

Manistee, Mich.—Plans for a draw bridge over Manistee River, are being prepared by Geo. S. Pierson, of Kalamazoo.

**Havre de Grace, Md.*—The following are the bids opened on Dec. 1 for the construction of sewers; Williams & Whitman, Engrs., Whitehall Bldg., New York, N. Y.; (*a*) The Ajax Constr. Co., Pittsburg, Pa.; (*b*) W. W. Read & Co., Niagara Falls, N. Y.; (*c*) Chas. Cook, Poughkeepsie, N. Y.; (*d*) F. E. Schneider & Co., Baltimore, Md., (awarded contract at a cost of about $17,241); (*e*) Geo. B. Stucker, Harrisburg, Pa.; (*f*) Stone, Grossart & Co., Philadelphia, Pa.; (*g*) Consolidated Eng'r'g Co., Baltimore, Md.; (*h*) Ford & Waldo, N. Y. City, N. Y.; (*i*) Bolton G. Coon, Kingston, Pa.; (*j*) Berghaus & Moffitt, Harrisburg, Pa.; (*k*) Philadelphia Working & Contr. Co., Baltimore, Md.; (*l*) Carl H. Ditmar, New York City; (*m*) P. Flannigan & Son, Baltimore, Md.; (*n*) The Smith Constr. Co., Philadelphia, Pa.; (*o*) Henry Spinach, Naugatuck, Conn.; (*p*) The Neff Co., New York City, N. Y.; (*q*) Hawman Bros., Reading, Pa.; (*r*) Russell Contr. Co., New York City, N. Y.; (*s*) Frank Pidgeon, Saugerties, N. Y.:

	a.	*†b.*	*c.*	*†d.*	*e.*	*f.*	*†g.*	*h.*	*i.*	*†j.*	*k.*	*†l.*	*m.*	*n.*	*†o.*	*p.*	*q.*	*†r.*	*†s.*
5,480 lin. ft. 6-in. pipe sewer	$0.38	$0.38	$0.45	$0.38	$0.48	$0.42	$0.46	$0.50	$0.47	$0.47	$0.50	$0.60	$0.34	$0.51	$0.61	$0.50	$0.52	$0.58	$0.73
6,575 " 8-in. " "	.47	.45	.50	.45	.56	.59	.58	.60	.66	.61	.60	.68	.44	.60	.73	.60	.60	.75	.83
1,610 " 10-in. " "	.55	.70	.60	.53	.63	.72	.85	.70	.82	.87	.70	.75	.55	.79	.80	1.10	.68	1.23	.95
515 " 12-in. " "	.71	.90	.75	.62	.76	.82	.86	.80	.81	.90	.86	.92	.70	.93	1.02	1.20	.80	1.35	1.05
440 " 15-in. " "	.92	1.00	1.00	.81	.97	.99	.90	1.00	.97	1.02	1.04	1.30	1.00	1.01	1.10	1.25	1.20	1.47	1.20
810 " 18-in. " "	1.05	1.35	1.25	.92	1.15	1.30	1.08	1.20	1.11	1.23	1.34	1.35	1.25	1.28	1.40	1.90	1.45	1.60	1.40
780 " 20-in. " "	1.30	1.60	1.50	1.19	1.44	1.61	1.26	1.40	1.51	1.64	1.61	1.60	1.50	1.52	1.60	2.00	1.70	1.81	1.80
831 " 24-in. " "	1.70	2.00	1.75	1.62	1.86	1.95	1.42	1.70	1.97	1.92	2.12	2.00	2.20	1.92	2.80	2.45	2.25	2.05	2.85
560 " 30-in. " "	3.50	3.50	3.00	3.17	3.12	3.47	2.15	3.00	3.25	3.46	3.56	3.15	3.75	3.50	3.00	4.00	4.30	3.23	5.40
310 pieces 6x4-in. Ys	.42	.92	.25	1.61	.22	.30	1.11	.60	.35	1.59	.75	.34	.40	.28	1.60	1.35	.34	1.48	1.30
277 " 8x4-in. "	.70	1.20	.35	2.08	.32	.45	1.48	.80	.42	2.12	1.10	.57	.55	.36	1.72	1.75	.50	1.68	1.75
70 " 10x4-in. "	1.10	1.72	.50	2.67	.46	.60	2.28	1.00	.45	3.03	1.55	.85	.70	.56	1.85	2.85	.66	2.24	2.41
23 " 12x4-in. "	1.40	2.68	.60	3.32	.58	.80	2.45	1.20	.60	3.25	2.10	1.12	.85	.66	2.00	3.65	.80	2.89	3.10
18 " 15x4-in. "	1.89	3.27	1.00	4.27	.93	1.10	3.00	1.60	1.20	3.92	2.75	1.83	1.00	1.12	2.70	4.00	1.30	3.78	3.97
42 " 18x4-in. "	2.36	4.10	1.40	5.08	1.32	1.59	3.90	2.10	1.40	4.75	3.50	2.60	2.00	1.58	2.99	5.85	1.75	4.58	4.87
42 " 20x4-in. "	3.00	5.25	2.00	6.70	1.72	2.04	4.50	2.70	1.60	6.91	5.00	3.35	3.00	2.07	5.05	6.65	2.25	5.75	6.08
42 " 24x4-in. "	4.50	6.67	3.00	9.36	2.45	3.00	6.00	3.70	2.85	8.49	7.00	4.98	4.00	3.20	6.70	8.75	3.25	8.18	9.35
18 " 30x4-in. "	11.50	12.25	5.00	11.65	4.35	5.90	11.28	4.70	7.50	15.96	9.00	10.73	7.50	5.40	14.00	20.25	9.50	17.70	15.20
Cast-iron pipe per ton	40.00	35.00	35.00	35.00	48.00	32.00	35.00	30.00	39.00	25.00	35.00	28.00	45.00	65.00	40.00	50.00	40.00	35.00	50.00
10 yd. concrete	6.00	6.50	7.00	6.50	7.00	6.50	5.64	5.00	6.00	4.40	7.00	6.00	6.50	7.00	5.00	9.00	7.00	6.00	8.00
Rock excavation, a cu. yd.	3.00	3.75	3.00	1.00	2.70	2.65	2.40	3.00	2.50	3.50	3.50	3.00	3.10	3.50	1.25	2.50	4.50	2.50	4.00
26 manholes	35.00	30.00	35.00	55.00	43.00	39.00	55.55	50.00	36.00	42.00	50.00	35.00	105.00	64.25	45.00	35.00	60.00	78.00	50.00
26 flush tanks	60.00	75.00	90.00	113.00	80.00	75.00	126.50	90.00	85.00	97.00	75.00	75.00	160.00	124.50	65.00	65.00	120.00	125.00	100.00
Lumber, per M. ft., B. M.	35.00	25.00	25.00	30.00	22.00	25.00	13.50	30.00	35.00	18.00	30.00	20.00	30.00	35.00	30.00	40.00	45.00	25.00	30.00

†Bid on branches includes 2 ft. of pipe.

Items marked thus give the names of parties awarded contracts.

**St. Paul, Minn.*—The following are the bids opened on Jan. 3 for reconstructing a portion of High Bridge;—(*a*) St. Paul Fdry. Co., St. Paul (awarded contract); (*b*) H. E. Horton & Co., Chicago, Ill.; (*c*) Minneapolis Steel & Machy. Co., Minneapolis, Minn.; (*d*) A. T. Bayne & Co., Minneapolis; (*e*) Milwaukee Bridge Co., Milwaukee, Wis.:

	**a.*	*b.*	*c.*	*d.*	*e.*
850,000 lbs. new material erected	$0.0502	$0.058	$0.0508	$0.0505	$0.0521
300,000 " old material erected, except girders	.0346	.05	.0352	.035	.035
54,000 " repairing, etc., plate girders.†	2,045	2,400	2,200	2,000	2,277
1,200 lin. ft. railing	2.10	2.50	2.25	2.15	2.35
600 " wood, floor system, sidewalks, etc.	8.90	10.00	8.45	9.00	9.50
Will pay for 420 tons old material, lump sum	3,864	3,360	3,738	3,780	3,637
Total	$59,091	$72,340	$59,972	$59,625	$61,945

†Lump sum.

Minneapolis, Minn.—It is stated that the Senate passed a bill authorizing this city to construct a bridge over the Mississippi River.

Fulton, Miss.—The Senate passed a bill authorizing Itawamba County to construct a bridge over Tombigbee River near here.

Syracuse, N. Y.—It is stated that the New York Central R. R. Co. (Henning Fernstrom, Chf. Engr., New York City) will expend about $100,000 for the construction of bridges along the line of West Shore R. R., in Syracuse, this year.

Columbus, O.—The Pennsylvania and the Baltimore & Ohio R. R. Cos. (D. D. Carothers, Chf. Engr., Baltimore, Md.) are stated to have prepared plans for a viaduct to be constructed at Reet Ave., at a probable cost of $100,000.

Harrisburg, Pa.—The lowest bid received and opened on Jan 10, by the Comrs. of Pub. Bldgs. & Grounds, for rebuilding substructure and superstructure of a bridge across Penns Creek, in Hartley Township, was submitted by Nelson & Buchanan Co., of Chambersburg, for $12,990.

Altoona, Pa.—City Engr. Harvey Linton and John Kline, of the Pennsylvania R. R. Co., are stated to have recommended the construction of a steel bridge to replace the 7th St. structure.

Philadelphia, Pa.—The Select Council is stated to have passed a resolution instructing the Dir. of Public Works to prepare plans for widening Chestnut St. bridge over Schuylkill River.

Allentown, Pa.—It is stated that the railway bridge crossing Lehigh River here has been destroyed by the flood of Jan. 6.

**Bovina, Wis.*—Jas. P. Garvey, of Freedom, is stated to have received the contract for constructing a 4-arch stone bridge here, for $6,795.

Milwaukee, Wis.—The budget for 1905 is reported to contain appropriations of $100,000 for the 47th St. viaduct, $250,000 for the 1st Ave. viaduct and $125,000 for a bridge at Kinnikinnic Ave.

Vancouver, B. C.—According to reports, the Northern Pacific and the Portland Railway Co. (H. O. Stipe, 421 Mohawk Bldg., Portland, Ore.) will construct jointly a bridge over Columbia River, at an estimated cost of $3,000,000.

PAVING AND ROADMAKING.

**Montgomery, Ala.*—Byron-Suders & Co., of Atlanta, Ga., are stated to have received the contract for paving S. Hull, Mildred and Monroe Sts. and Madison Ave.

San Francisco, Cal.—See "Sewerage and Sewage Disposal."

Waterbury, Conn.—The following bids are stated to have been opened Jan. 3, by the Bd. of Pub. Wks., for constructing the macadam road here: Edward McManus, of Waterbury, $3.20 for trap rock macadam and $3 for local stone; Frank Pigeon, of Saugerties, N. Y., submitted bids ranging from $2.80 to $3.70 (price given per lin. ft.).

Augusta, Ga.—See "Water."

Chicago, Ill.—The joint committee from the South Park and Lincoln Park Boards and the City Council on Jan. 5 approved plans for a connecting link between the north and south side boulevard systems at an estimated cost of $4,500,000. Of this sum the committee sanctioned an expenditure for the purchase of land and buildings fronting in Michigan Ave., Pine St. and Lincoln Park Boul., reaching $3,934,534. Other plans of the committee, still under consideration, include the construction of a boulevard bascule bridge 100 ft. wide over the river east of the Rush St. Bridge bet. Michigan Ave. and Pine St., to cost approximately $500,000.

Bids will be received Jan. 19, by the South Park Comrs., at 57th St. and Cottage Grove Ave., for furnishing and delivering approximately 1,200 sq. yds. creosoted pine paving blocks. E. G. Shumway, Secy.

Topeka, Kan.—Bids will be received by J. H. Squires, City Clk., on Feb. 6 for 14 blocks of brick pavement, two courses of brick on sand foundation. Jas. F. McCabe, City Engr.

Beverly, Mass.—Mayor Wallis in his annual message recommends that a committee be appointed to confer with a committee of the shore residents in regard to the building of a State highway from Chapman corner to the Manchester line. A committee of summer residents is raising $25,000 to be spent in reconstructing the shore road, if the city will repair and rebuild the Wenham Road and repair some of the other roads.

**Boston, Mass.*—J. M. McCarthy, Clk. Massachusetts Highway Comn., writes that the contract for building a section of the State highway in Rutland, about 5,800 ft. in length (bids opened Dec. 22) has been awarded to Bruno & Milano, 293 North St., for $6,367.

Detroit, Mich.—Bids to include plans and specifications will be received Jan. 10, by the Dept. Pub. Wks., for furnishing material, erecting and equipping plant for making brick for paving purposes; plant to have 20,000 and 30,000 capacity, respectively, and to be owned and operated by city. Wm. H. Maybury, Comr.

Grand Rapids, Mich.—It is stated that the estimated cost of paving portions of W. Leonard and Scribner Sts. with brick is $25,840 and $40,390 respectively, and with asphalt on Scribner St. is $32,170.

St. Louis, Mo.—Local press reports state that bids will be received Jan 27, by the Bd. Local Improv., for paving numerous streets.

**Tom's River, N. J.*—The contract for constructing a gravel road, about 23,753 ft. in length, in Lacy Township (bids opened Dec. 27) is stated to have been awarded to Louis Rafetto, Drexel Bldg., Philadelphia, Pa., for $17,133.

Cortland, N. Y.—Bids will be received by the Bd. of Pub. Wks., on Jan. 26, for paving several streets with either sheet asphalt, vitrified brick or block or bitulithic pavement, as advertised in The Engineering Record.

Little Falls, N. Y.—See "Sewerage and Sewage Disposal."

Cleveland, O.—Bids will be received until Jan. 25, by A. R. Callow, Secy. Bd. Pub. Service, for paving with brick on portions of 16 streets.

Bowling Green, O.—Road improvement bonds amounting to $50,000 are reported sold.

Youngstown, O.—See "Sewerage and Sewage Disposal."

Cleveland, O.—The County Comrs. are reported to be considering the widening of the Lake Road to 80 ft. and macadamizing the same.

Cincinnati, O.—Bids will be received Jan. 19 by the Bd. Pub. Service, for furnishing material and resurfacing with asphalt a portion of Court St.; also on Feb. 1 for grading, curbing, flagging gutters and macadamizing portions of Observatory Ave. and Oliver St.; also Feb. 2, for grading, curbing with granite and paving with granite blocks a portion of Beekman St. Geo. F. Holmes, Clk.

**Xenia, O.*—G. A. McKay, City Engr., writes that Kemp & Sons, of Middletown, have secured the contract for about 25,650 sq. yds. of brick paving on Main St. at $1.38 per sq. yd. outside car tracks, and $1.50 between the tracks; total cost $38,346 (bids opened Dec. 20).

**Portland, Ore.*—The State Portage Com. is stated to have awarded the contract for constructing the Portage Road to Nelson & White, of Seattle, for $115,523.

**Philadelphia, Pa.*—The contract for repairs to asphalt streets for 1905 (bids opened Dec. 15) is stated to have been awarded to Filbert Paving & Constr. Co., 1507 Sansom St., at $1.67 per sq. yd.

Esplen, Pa.—See "Sewerage and Sewage Disposal."

Easton, Pa.—Mayor Lehr, in his annual message, recommends the extension of the paved streets and the laying out of a new park.

Harrisburg, Pa.—Bids will be received Jan. 18, by the State Highway Dept. of Pa., for constructing 7,700 ft. road in Swatara Township.

Ingram, Pa.—Bids will be received Jan. 19, by the Boro. Council, for grading, curbing and paving a portion of Linden Ave.; approximate quantities, 3,500 cu. yds. grading, 2,956 ft. dressed stone curbing, 180 ft. rough stone curbing, and 5,100 sq. yds. brick block paving (Standard Fire Brick Co. block). John McBride, Boro. Engr., Rm. 46 Fidelity Bldg., Pittsburg.

**London, Ont.*—The following are the bids opened on Dec. 22 for a brick pavement on Kings St. (A. O. Graydon, City Engr.). This work includes 11,722 sq. yd. of brick on 5-in. concrete foundation, 2-in. sand cushion, Pioneer asphaltum fill along curb and 5 joints filled with same, every 50 ft., the remainder filled with cement grout, and 4,400 lin. ft. 6-in. concrete curb; Thos. Cluck & Co., Windsor, $14,085, city to supply brick; City Engineer's tender for work only $14,200, city to supply brick; Toronto Constr. Co., $13,138, city to supply brick; same company, $28,477, using Canton brick; John Geary, London, $13,168, city supply brick; same company, $25,689, using Logan brick (awarded contract); Forest City Paving Co., London, $14,140, city to supply brick; A. J. Murphy, Sarina, $30,943, using Massillon brick; same company, $29,740, using Canton brick; John Mann & Sons, Sarina, $29,047, using Mack brick; Newan Bros, Windsor, $17,500, work only; Carland & Clancy, Ann Arbor, Mich., $28,576, using Canton brick.

The following are the bids received for furnishing the brick (price given per M.) f. o. b. London, duty to be paid by the companies submitting bids: Ontario Paving Brick Co., Toronto, $20; Logan Brick Mfg. Co., Toledo, O., $23.40; Metropolitan Co., Canton, O., $28.50; Massillon Fire Brick Co., Massillon, O., $27.70; Canton Co., Canton, O., $27; Mack Co., $28.70,

POWER PLANTS, GAS AND ELECTRICITY.

Dadeville, Ala.—The Tallapoosa Water, Power & Electric Co. is reported formed to promote the development of 8,000 h.p. on Tallapoosa River, in the vicinity of Sturdevant, for manufacturing purposes; capital, $500,000. Mrs. R. T. Parker, of Dadeville, is reported to be one of the incorporators.

Little Rock, Ark.—It is reported that bids will be received Jan. 18 by the Bd. Pub. Affairs for erecting and installing a 350-h.-p. boiler and equipment at electric light plant. F. M. Oliver, Clk.

Colton, Cal.—There is reported to be a movement here for a municipal electric light and power plant.

Arcata, Cal.—Brousse Brizard, Pres. Arcata Light & Power Co., writes that it is proposed to purchase at once a complete equipment for transformer station, including three 100-kw. transformers, one 10,000-volt oil switch, and 80 assorted sizes of meters, 5 to 10 amp.; probable cost, $6,000. Engineer, H. L. Jackman, Eureka.

Anaheim, Cal.—E. B. Merritt, City Clk., writes that Bird V. Beebe and L. E. Miller, of Anaheim, have secured a franchise for a gas pipe line.

Calistoga, Cal.—Frank Teale, City Clk., writes that G. S. Cutler, of Calistoga, has secured a franchise to construct and operate an electric light system.

Indio, Cal.—W. F. Everett, Secy. Indio Light, Water & Ice Co., writes that it is proposed to construct water works, an electric light plant and a 10-ton refrigerating and ice plant.

**Leadville, Colo.*—The McBride Electric Co., of St. Paul, Minn., has secured the contract for conduits and wiring for the U. S. Post Office at Leadville (bids opened Dec. 27), for $1,247.

Washington, D. C.—Bids will be received Jan. 24 at the Bureau Supplies and Accounts, Navy Dept., Washington, for furnishing the navy yards, Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C.; Norfolk, Va.; Key West, Fla., and Pensacola, Fla., a quantity arc lamps, electrical supplies, brick, sand, pipe bender, bar steel, corrugated steel, c. i. pipe and specials, valves, incandescent lamps, wire, cable, conduit and fittings, ventilating sets, miscellaneous electrical supplies, wire, crucible steel wire, La Farge cement, corrugated sheet steel, bar iron, bar steel, rivet steel, tool steel, Rex tool steel, Howe tool steel, plain and galvanized sheet steel, castings, brass pipe, iron pipe, pipe fittings, etc. H. T. B. Harris, Paymaster-Gen., U. S. N.

Speaker Cannon is stated to have received from Bernard H. Green, Supt. of the Congressional Library, a report recommending the construction of a central power station to supply all the uptown Government departments in the vicinity of the White House with light, heat and power. The report was made on a request by Congress last April. The plan provides for the removal of all boilers and engines from the departments in question, and the establishing of a single distributing point, with a system of conduits for the transmission of steam and electricity to the various scattered buildings. The estimated cost of the plant is $2,000,000, and it will cost about $200,000 a year to operate it.

**Greensboro, Ga.*—The Electric Supply Co., of Savannah, is stated to have secured the contract for constructing the municipal electric light plant, for about $10,000.

Ft. Valley, Ga.—Mayor J. L. Fincher is reported interested in the construction of an electric light plant.

Elgin, Ill.—It is reported that the Elgin American Gas Co. proposes enlarging its plant. Walter Godey, Secy.

Orleans, Ind.—Heise Bros. & Co. are stated to have secured a franchise for a lighting plant.

Indianapolis, Ind.—The Indianapolis Light & Power Co., and the Marion County Hot Water Heat Co., are reported to have been merged in the Indianapolis Light & Heat Co. This company furnishes street lights in Indianapolis, and also furnishes most of the electricity used in commercial lighting and power. The new company will probably increase the equipment.

Shelburn, Ind.—C. Wm. Whaley and Noland B. Stadley, 27 N. 8th St., Terre Haute, are reported to have secured a 20-yr. city and commercial lighting franchise in Shelburn. The plant will be located between Shelburn and Hymera.

Indianapolis, Ind.—It is reported that bids will be received Jan. 23 by the Bd. School Comrs. for installing electric light and gas fixtures in Shortridge High School. Vanegut & Bohn, Archts., Indiana Trust Bldg.; John E. Cleland, Secy.

Marion, Ind.—It is reported that the power plant owned by the Pittsburg-Columbia Oil Co., recently destroyed by fire, will be rebuilt, to be used for the generation of electricity.

Columbus, Ind.—It is stated that bids wi be received Feb. 2, by the Common Counci for two 150 h.p. boilers, designed for 150 l working pressure; all necessary foundatio work, brick settings, steam piping, smoke stacks, etc. Geo. Vorwald, City Clk.

Des Moines, Ia.—The Capital City Ga Light Co. is reported to be planning th building of about 12 miles of extensions t its system of supply mains this season.

Chariton, Ia.—It is reported that the cit will rebuild the electric light plant, at a co of $40,000.

Waterloo, Ia.—The Waterloo & Cedar Fal Gas & Electric Light Co. has been incorporated, with a capital of $595,000, with headquarters at Waterloo. It will engage in general gas and electric business, and is in corporated with the principal object of con structing a gas plant at Cedar Falls, wher a franchise was recently granted. Directors J. H. Leavitt, G. E. Lichty, Geo. McLean, an others.

Coffeyville, Kan.—Rosa Bell, City Clk writes that bids are wanted Jan. 18 for th construction of an electric light plant; cos not to exceed $15,000. Engineer, W. E Palmer, of Kansas City, Mo.

Lake Charles, La.—The City Council i reported to be considering the establishmen of an electric light plant.

Melrose, Mass.—Mayor Sidney H. Buttrick in his annual message, is reported to hav recommended that steps be taken to establis a municipal lighting plant.

West Bay City, Mich.—The Bay City Ga Co., of Bay City, is stated to have secured franchise to furnish West Bay City with ga for heating and lighting purposes.

Northville, Mich.—The Common Council i stated to have granted a franchise to C. A Ward, of Ann Arbor, for furnishing electricity for lighting the streets and residences and power for factories in the town. The franchise is for 30 yrs. and carries with it a 10 yr. contract to supply the village and private consumers. The company will develop it electricity near Hamburg, on the Huron River where it will build 3 dams. Generators wil be placed at each dam, and the electricity turned into the feed wires which go to Northville, South Lyon, Ypsilanti, Ann Arbor and other points.

Ann Arbor, Mich.—Ross Granger, City Clk. writes, in regard to the lighting of the cit streets, that plans are now being prepare but no definite action has yet been taken Address Wm. Goodyear, Alderman.

Houston, Miss.—J. M. Griffin, Town Clk. writes that an election will be held on Feb. to vote on issuing bonds for the constructio of a combined water works and electric ligh plant. No engineer selected as yet.

Mexico, Mo.—Wallace Dearing, City Clk. writes that it was voted Jan. 2 to grant Wm McCabe a franchise for a gas plant.

St. Louis, Mo.—The Bd. of Pub. Improv. i stated to have approved the bill providing fo the construction of an electric light plant a the city insane asylum.

Bayonne, N. J.—Mayor Brady is reporte to be in favor of a municipal electric ligh plant.

Spring Lake, N. J.—Bids will be receive Jan. 17th (change of date), by the Boroug Engineer, for furnishing and installing 1 h.p. marine type boiler, air compressor, fee water heater, boiler feed pump, steam sepa ators, etc., in power house at Spring Lake.

Middletown, N. Y.—The Orange Coun Lighting Co., of Middletown, has been inco porated, to manufacture gas and electr lighting; capital, $100,000. Incorporator P. N. Jackson and Percy Ingalls, Newark, J., and T. L. Reeve, Middletown.

**Oswego, N. Y.*—The People's Gas & Ele tric Co. is stated to have secured the co tract for lighting the city for 5 yrs. at $ per arc light per yr., and $3.65 per yr. f incandescent lights.

Lyons, N. Y.—Wm. Morris, of Penn Ya is stated to have purchased the gas plan and will install new apparatus.

Oxford, N. C.—Bids will be received Henry A. Pressey, C. E., 1416 F St., Washin ton, D. C., on Jan. 25 for the construction water works, an electric light plant and ice plant at Oxford, N. C., as advertised The Engineering Record.

Rockingham, N. C.—Hugh McRae & C bankers, of Wilmington, are reported to ha purchased property along Pee Dee River, a will soon begin the development of Bluet Falls, on the Pee Dee, to supply that secti with electric power.

Mt. Vernon, O.—Mr. Hubbell and othe are reported to have secured a franchise f an electric light plant, which will be co structed and operated under the name of t Citizens Electric Co.

Toledo, O.—Press reports state that t Toledo Htg. & Light Co. contemplates ext sions and improvements this spring, inclu ing the institution of an alternating elect current to light the city.

Lakewood, O.—Bids will be received Feb by the Bd. Educ. for furnishing and installi gas and electric fixtures in Lakewood Hi School. L. W. Thomas, Archt., Bangor Bld Cleveland. Otto C. Muehlhauser, Clk.

**Items marked thus give the names of parties awarded contracts.*

ncinnati, O.—Local press reports state the Cincinnati Gas & Electric Co. will nd about $500,000 in the West End, and t $200,000 in the East End.

ingo, O,—The Water Works Co. is re- ed to have decided to construct a new rvoir and remodel the electric light plant.

regon City, Ore.—The Portland General :tric Co. (H. W. Goode, Pres., Portland) eported to be preparing plans for the con- ıction of a 40,000-h.-p. electric plant at lamette Falls, Oregon City. E. Hippeley, ?ortland, is Ch. Engr.

'ortland, Ore.—E. T. Burrowes is stated have petitioned City Council for permis- ı to build a conduit on Middle and Con- ss Sts.

;tate College, Pa.—The Nitanny Light, ıt & Power Co., of State College, is report- incorporated, with a capital of $10,000.

Philadelphia, Pa.—The Commonwealth :ctric Co., of Philadelphia, has been incor- :ated, to supply light, heat and power, by ans of electricity, to Philadelphia; capital, 00,000. Incorporators: Mark Hyman and ss A. Mackey, New York, N. Y.; Graham mner, Englewood, N. J., and John M. Ing- m, Philadelphia.

Deadwood, S. D.—Press reports state that e proprietors of the Black Hills Electric ght Co., of Deadwood, and the Belt Light Power Co., of Leadville, are about to be ırchased by a new company to be known as e Black Hills Consolidated Electric Light Power Co. J. J. Henry, of Denver, Colo., reported to be here negotiating the deal. ıe new company will probably make exten- ve improvements.

Memphis, Tenn.—The Merchants' Power o. is reported organized, with a capital of 500,000, to build and equip a plant to sup- ly private consumers. They will also con- truct a plant to supply the city, and will ive city the option of buying either of both lants.

Grandview, Tex.—The Grandview Mill, ıght & Ice Co., of Grandview, is reported ncorporated, with a capital of $20,000, o operate a corn mill, ice factory and elec- ric light plant. Incorporators: W. B. Head, ł. E. Pitts, T. E. Pittman, and others.

American Fork, Utah.—J. H. Wooten, Mgr. Jtah County Light & Power Co., is reported :o have prepared details for the erection of :he proposed light and power plant in Ameri- :an Fork canyon. It will be operated by both water and steam, and cost is about $400,000.

Milwaukee, Wis.—Local press reports state that in the budget for 1905 a provision of $400,000 is made for a municipal lighting plant.

Cadott, Wis.—The Cadott Light & Power Co., of Cadott, has been incorporated, with a capital of $4,000, by R. B. Cunningham, J. A. McGillivray, H. W. Frasl, and others.

Chihuahua, Mex.—The Government of the State of Chihuahua is reported to have granted to Col. W. C. Greene, the copper magnate of New York, N. Y., and Cananea, Mexico, two concessions for the establishment of industrial enterprises in that State. One is for the establishment of a smelter and the construction of railroad and telegraph and telephone lines and electric power plant, and the other is for the establishment of a large paper mill, a furniture factory, and lumber mills. It is stated that more than $3,000,000 gold are to be invested in these enterprises by Col. Greene.

St. Thomas, Ont.—The citizens are reported to have voted Jan. 2 to purchase the St. Thomas gas and electric light plant, for $205,000.

ELECTRIC RAILWAYS.

Van Buren, Ark.—The Van Buren Electric Ry. & Bridge Co. has been incorporated to construct a street railway in Van Buren and an interurban line between Van Buren, Alma and Mulberry, Crawford County, with a capital of $500,000. Incorporators: Philip D. Scott, Chas. H. Drennan, S. L. Scott and others.

San Jose, Cal.—Roy E. Waller, City Clk., writes that J. F. Parkinson, of Palo Alto, on Jan. 3, secured a franchise for an electric railway.

Stockton, Cal.—The Stockton Electric R. R. Co. is reported to have entered into an agreement with the West End Improvement Co., to build an extension to Poplar and Stockton Sts. into the heart of West End tract.

Alton, Ill.—The Alton, Jacksonville & Peoria Ry. Co. has petitioned for a franchise in Alton and North Alton. J. M. Rhoads, Secy., Upper Alton.

The Alton, Granite & St. Louis Traction Co. has petitioned for a franchise on Belle St.

Edwardsville, Ill.—The Edwardsville, Alton & St. Louis Ry. Co. has been organized with a capital of $300,000, to construct a line from Mitchell to Edwardsville. F. E. Allen, Pres., St. Louis, Mo.

Granite City, Ill.—The Granite City, St. Louis & Eastern Belt R. R. Co. has been organized to operate a belt railroad in Granite City and vicinity. Incorporators: F. G. Niedringhaus, H. F. Niedringhaus and Wm. F. Niedringhaus, of St. Louis, Mo., and W. W. Hanlon and C. F. Stelzel, of Granite City, Ill.

Glenwood, Ia.—Col. Jas. A. Swope and L. B. Hanson are reported interested in the Iowa & Nebraska Interurban Electric Transit Co., which will build a line between Rockeport, Mo., and Omaha, touching Sidney, Hamburg, Taber, Glenwood and Malvern, Ia., and crossing Missouri River at a point opposite Bellevue, Neb.

Wichita, Kan.—Extensive improvements, fully doubling the power capacity of the Wichita Railroad & Light Company's plant in this city, are stated to have been decided upon by the company. The improvements will be made under the direction of L. O. Williams.

Pittsfield, Mass.—It is reported that the Pittsfield St. Ry. Co. is to build a power plant. The site most favorably considered is in Coltsville.

Hattiesburg, Miss.—An interurban railway is projected from Hattiesburg to Laurel, 29 miles. C. J. Abbott is reported interested.

Missoula, Mont.—The Amador Ry. Co., with a capital of $1,000,000, has been incorporated by Robt. M. Mahler, Chicago; Wm. Sherman, Carlinville, Ill., and Erasmus B. Waples, Wilmington, Del., and others, to construct and maintain a railway system from a point on the Coeur d'Alene branch of the Northern Pacific, where it crosses Clear Creek, to the Amador Mining Company's property.

Steubenville, O.—It is reported that an extension of the line of the Steubenville & Wheeling Traction Co., from Martin's Ferry to Brilliant, will be built this year. The road will be 15 miles long and will connect Steubenville with Wheeling.

Toledo, O.—The Toledo & Point Place Ry. Co. has commenced condemnation proceedings to secure certain pieces of right of way necessary to complete its line. The company expects to build a road to Point Place, a pleasure resort on the lake shore north of Toledo.

Bowling Green, O.—The Lake Erie, Bowling Green & Napoleon Ry. Co. has been granted a franchise to extend its line through the city. The company plans to build to Napoleon.

Canton, O.—The Canton-Akron Ry. Co. is reported to be planning to increase the capacity of its main power station by installing a large turbo-generator.

Columbus, O.—The Columbus, New Albany & Johnstown Traction Co. has increased its capital from $200,000 to $600,000. The increase is for the purpose of extending the road from Gahanna to Johnstown, 24 miles. Work on the extension will start in the spring, all right of way having been secured. A contract has been placed with the Mount Vernon Bridge Co., Mt. Vernon, O., for a steel bridge. W. D. Brickell, Pres.; L. P. Stephens, Secy. and Genl. Mgr.

Youngstown, O.—The Youngstown & Canton Ry. Co. is making a new survey for its proposed line and is purchasing right of way. John E. Monnot is at the head of the company.

Cleveland, O.—It is reported that J. V. Ward, promoter of the Cleveland, Canton & Canal Dover Ry., states that New York financiers have agreed to take half the bonds on the proposition. An engineering concern is making a report on the proposition.

Lorain, O.—The West Side Street Ry. Co. has been incorporated, with a capital of $10,000, by W. B. Thompson, Orville Root, F. W. Pierce, R. Thew and others, to build a new street railway to the new steel mill district.

Charleston, S. C.—The City Council has granted the Charleston & Summerville Electric Ry. Co. a franchise to lay tracks and operate cars through certain streets and thoroughfares of the city.

Pomeroy, Wash.—The Pomeroy-Clarkston Electric Ry. Co. is soon to be incorporated to build, equip and maintain an electric railway between Pomeroy and Clarkston. Wm. McCarroll, V. D. Norman, A. S. Burnett and others are reported interested.

Clarksburg, W. Va.—The Clarksburg & Weston Traction Co. has been incorporated to construct and operate an electric railway between Clarksburg and Weston; capital, $25,000. Incorporators: Frank B. Haymaker, of Charleston; C. Fittro, and Wyckoff M. Conaway, of Clarksburg, W. Va., and others.

Hamilton, Ont.—The construction of the Hamilton, Ancaster & Brantford Electric Ry. will be begun in about 30 days. The road will be built by Elmer T. Haines, Hotel Waldorf, Hamilton, Ont.

RAILROADS.

Wilson, Ark.—The Wilson Northern Ry. Co. is reported incorporated, with a capital of $100,000 to construct a railroad from Wilson to Keiser, a distance of 10 miles. Directors: Robt. E. L. Wilson, of Memphis, Tenn., Chas. T. Coleman, of Little Rock, and others.

Jamestown, Cal.—The Jamestown & Yosemite Valley R. R. Co. is reported incorporated. with a capital of $1,000,000, by T. S. Bullock, S. D. Freshman, S. H. Smith and others, to construct a line from Jamestown to a point at on near Mariposa, about 40 miles long; also an intermediate branch 35 miles long, extending into Yosemite Valley. The papers of incorporation provide for the use of steam, electricity or any other motive power.

Howard, Colo.—The Denver & Rio Grande R. R. Co. is stated to have amended its articles of incorporation to permit the building of two extensions. One of the new branches will run from Howard, to the mineral deposits, by way of Howard Creek, and the other extension will be from Sargents to Tomichi. E. J. Yard, Ch. Engr., Denver.

New Haven, Conn.—The N. Y., N. H. & H. R. R. Co. is reported to be considering the double tracking of the New Haven & Derby, between New Haven and Derby Junction. Colin M. Ingersoll, Ch. Engr., New Haven.

Miami, Fla.—The Florida East Coast R. R. Co. is stated to have decided to build an extension of its line from its southern terminus at Miami to Key West, 136 miles. R. T. Goff, Gen. Supt. St. Augustine.

Kankakee, Ill.—The Illinois Central R. R. Co., which is at present a double track line between Chicago and Kankakee, is about to become a 4-track system. A corps of engineers is about to lay out the route for the two additional tracks: length of proposed line is 56 miles. H. U. Wallace, Ch. Engr., Chicago.

Indianapolis, Ind.—Press reports state that among the improvements planned by the Pennsylvania R. R. (W. H. Brown, Ch. Engr., Philadelphia, Pa.) is the double-tracking of the line between Indianapolis and Richmond, Ind.

Ardmore, Ind. Ter.—Press reports state that the Rock Island R. R. Co. (W. L. Darling, Ch. Engr., Chicago, Ill.) is about to begin extending its line from Ardmore westward.

Ft. Madison, Ia.—The Santa Fe R. R. Co. is reported to be making plans to double track its line from Ft. Madison to Nixon, in Ia., a distance of 10 miles. W. B. Storey, Ch. Eng., Topeka.

Sioux City, Ia.—The Great Northern Ry. Co. (A. H. Hogeland, Ch. Engr., St. Paul, Minn.) is reported to have in contemplation the construction of a double track steel structure from the combination bridge down 3d St. to Division St., a distance of 7,950 ft.; the laying of a union industry track on the surface of 3d St.; the construction of a passenger station at 4th and Howard Sts., and the restoring of its machine shops in Division St. All this is preliminary to the early construction of links of railroad in Nebraska to connect the Great Northern and Burlington systems.

Lynn, Mass.—The Boston & Maine R. R. Co. (H. Bissell, Ch. Engr., Boston) is reported to have under consideration the elevation of its tracks from the West Lynn station to a point on Green St.

Mayville, Mich.—The Pere Marquette R. R. Co. (F. H. Alfred, Ch. Engr., Detroit) is reported as having surveyors working between Fostoria and Mayville with the view of extending the Flint River branch to Mayville. This will give the road a short line between Flint and Port Huron.

Brookhaven, Miss.—It was stated that the Mississippi Central R. R. Co. proposes extending its line from Silver Creek to Brookhaven. M. H. McCabe, Supt., Hattiesburg, Miss.

Columbus, O.—Bids will be received Jan. 18, by the Bd. Pub. Service (Julian Griggs, Ch. Engr.), for furnishing material, laying and ballasting railroad tracks adjacent to Scioto River, in all about 11,000 lin. ft. Chas. H. Frank, Secy.

Elk City, Okla. Ter.—A charter has been issued to the Oklahoma & Northwestern R. R. Co., with a capital of $1,875,000, with its principal places of business at Elk City and Chicago. Edwin E. Neiss, Fred. F. Krause and others of Chicago, Ill., are the incorporators. The estimated length of the railroad is 75 miles, starting from a point in Rogers Mills County, Okla. Ter., probably Elk City, running in a northwesterly direction through Roger Mills, Day, Woodward and Beaver Counties in Okla. Ter., with a branch extending from an undetermined point on said road in a southerly direction to the north bank of the South Fork of the Red river near Sayre; estimated cost of the railroad is $1,500,000.

New Castle, Pa.—Preparations are reported as being made by the Pittsburg, Bessemer and Lake Erie R. R. Co. to extend its Allegheny and Western line from Queens junction, 11 miles north of Butler, down the Muddy Creek valley to New Castle. J. A. Atwood, Ch. Engr., Pittsburg.

Sharon, Pa.—Plans for straightening the line on the Mahoning division of the Erie R. R. (C. W. Buchholz, Consulting Engr., New York, N. Y.) from Shenango to Youngstown have been prepared by the enginering department of that road. The scheme involves the elimination of a number of bad curves and the reconstruction of several bridges. The cost of the new construction and other improvements will be about $50,000.

**Stonega, Va.*—J. R. Rhodes & Co., Knoxville, Tenn., are stated to have secured the contract for constructing 12 miles of railroad from Stonega, Va. to Norton. The line, which will be a coal road, will be built by the Virginia Coal & Iron Co. James McDonald, of Knoxville, will be associated with J. R. Rhodes & Co. in the construction of the line.

Casper, Wyo.—The extension of its Colorado line from Ft. Collins to Cheyenne and the building of its Wyoming branch from Orin Junction to Casper, are among the first contemplated improvements for the Colorado & Southern R. R. Co. (H. W. Cowan, Ch. Engr., Denver) during the year 1905.

It is reported to have been decided by the Chicago & Northwestern R. R. Co. (E. C. Carter, Ch. Engr., Chicago, Ill.) to begin construction work on an extension of its road from Casper to Lander.

Chihuahua, Mex.—See "Power Plants, Gas and Electricity."

PUBLIC BUILDINGS.

Batesville, Ark.—Bids will be received by the Superv. Archt., Treas. Dept., Washington, D. C., on Feb. 14 for the low-pressure steam-heating apparatus for the U. S. Post Office and Court House at Batesville, as advertised in The Engineering Record.

**Harrison, Ark.*—The Springfield Plumbing Co., of Springfield, Ill., has secured the contract for installing heating apparatus in U. S. Post Office (bids opened Dec. 20) for $3,656.

San Francisco, Cal.—See "Sewerage and Sewage Disposal."

Los Angeles, Cal.—Bids will be received Jan. 27 by T. J. Cochrane, Treas. Pacific Branch, N. H., D. V. S., Soldiers' Home, for installing steam heating. system in Canteen building.

**Leadville, Colo.*—E. J. McDonough Co., of Chicago, Ill., has secured the contract for installing heating apparatus in U. S. Post Office (bids opened Dec 30) for $3,625.

Hartford, Conn.—Bids will be received Feb. 1, by Geo. M. Cole, Brigadier Gen. C. N. G., Secy. Armory Comn., at State Capitol, for erecting, including heating, electric work and plumbing, an arsenal and armory; probable cost $350,000. Davis & Brooks, Archts., 49 Pearl St.

Washington, D. C.—The following are the bids opened on Jan. 5 by Bernard R. Green, Supt. of Construction, Bldg. for Museum, Library of Congress, for steel girders, beams and columns required for first floor of the National Museum: American Structural Steel Co., Pittsburg, Pa., $78,374; Ryan & McFarren, New York, N. Y., $85,700; Champion Iron Co., Kenton O., $79,267; Penn Bridge Co., Beaver Falls, Pa., $81,469; L. F. Shoemaker & Co., Philadelphia, Pa., $98,821; Phoenix Iron Co., Philadelphia, Pa., $74,848; Milliken Bros., New York, N. Y., $84,227; American Bridge Co., New York, N. Y., $73,900; L. Shriver & Sons Co., Cincinnati, O., $82,011, and Cambria Steel Co., Philadelphia, Pa., $85,800.

Ocala, Fla.—Bids will be received Feb. 6, by the Bd. Co. Comrs., for erecting a court house. Probable cost, $45,000. Plans may be obtained on deposit of $35, which will be refunded on return of same. H. J. Kentho, Archt, Uedeman Bldg., Jacksonville; S. T. Sistrunk, Clk.

Augusta, Ga.—See "Water."

Decatur, Ill.—Bids will be received by the Superv. Archt., Treas. Dept., Washington, D. C., on Feb. 23, for construction complete of U. S. Post Office at Decatur, as advertised in The Engineering Record.

Evanston, Ill.—Plans have been completed by Jas. Gamble Rogers, Clark and Randolph Sts., Chicago, for the public library which is to be erected in the spring, at Orrington Ave. and Church St. It is to be a 3-story, 54x146-ft. building, and is estimated to cost $70,000.

Michigan City, Ind.—It is reported that plans are being prepared for a hose house to be erected on 4th St. H. R. Miles, City Engr.

Jeffersonville, Ind.—Bids are wanted Jan. 27 for constructing a storage building at Jeffersonville depot. Address J. M. Marshall, A. Q. M. G., U. S. A.

Des Moines, Ia.—Local press reports state that the following bids were received Jan. 5 by the Bd. of Superv. for work in connection with the erection of the court house:

Ventilating and Steam Heating—John Collis Co., $45,830; Des Moines Plumbing Co., $40,508; Wallace & Linane, $40,350; Pond & Hazen, $41,180; Simmons & Powers, $41,389; Iowa Light, Heat & Power Co., $36,593; Lewis & Ketcham, $40,985; L. H. Kurtz, $44,240; E. Van Dyck, $43,858.

Plumbing and Gas Piping—Des Moines Plumbing Co., $9,965; Wallace & Linane, $7,832; Edwin Cutler, $13,500; E. Van Dyck, 820 Walnut St., $7,442; Cochrane Heat & Power Co., $9,879; Simmons & Powers, $9,704.

Roofing and Metal Work—H. W. Schluter & Co., $13,175; Gate City Steel Roofing Co., $9,794; St. John & Barquist Co., $11,250; Grayhall & Peterson Co., $10,945.

Steel and Fireproofing Tower—Columbian Fireproofing Co., $10,732; Des Moines Bridge & Iron Wks., $10,500; H. W. Schlueter & Co., $10,320.

Henderson, Ky.—The following are the bids opened on Jan. 9, by the Superv. Archt. Treas. Dept., Washington, D. C., for the construction of the U. S. Post Office at Henderson: Walter Brashear, Henderson, $44,000; Edw. Henry, Tipton, Ind., $37,845; W. H. Bailey, Henderson, $40,548; Krause Mfg. Co., Richmond, Ind., $48,755; J. E. Barnes & Son, Logansport, Ind., $33,000; Geo. Moore & Son, Nashville, Tenn., $39,890, and Savannah Constr. Co., Savannah, Ga., $39,793.

Oakland, Md.—The Co. Comrs. have decided to erect a new jail in this city, the cost, including equipment, to be about $35,000.

The town authorities have decided to erect a city hall with lockup, at First and Liberty Sts.

Springfield, Mass.—The City Hall was destroyed by fire on Jan. 6.

Ft. Wayne, Detroit, Mich.—Bids will be received by Capt. P. Whitworth, Q. M., U. S. A., on Jan. 25 (readvertisement) for constructing, plumbing, heating and electric wiring brick guard house, as advertised in The Engineering Record.

**Items marked thus give the names of parties awarded contracts.*

Detroit, Mich.—Bids are wanted Jan. 16 for $120,000 public building bonds. F. A. Blades, City Compt.

Fairmont, Minn.—The Co. Comrs. have decided to appropriate $100,000 for the building of a new court house.

Elbow Lake, Minn.—It is reported that the Bd. of Co. Comrs. will soon ask bids for erecting the Grant County court house, which is to cost about $50,000. Bell & Detweiler, of Minneapolis, are the archts.

Sardis, Miss.—R. P. Eckler, Deputy Co. Clk., writes that the plans of Wethers & Co., of Memphis, Tenn., have been accepted for rebuilding the court house; probable cost of work, $35,000. Bids for construction will be received Mar. 6.

St. Joseph, Mo.—Eckel & Mann, Commercial Bank Bldg., it is reported, have submitted a report to the county court, in which they estimate the cost of making improvements to the court house at approximately $22,172.

Seward, Neb.—Geo. Berlinghop, of Beatrice, has been appointed by the Co. Comrs. to supervise the construction, and to prepare plans for the new court house for which an issue of $100,000 bonds was authorized by the citizens at the Nov. election.

Ft. Crook, Neb.—Bids will be received until Jan. 30 by Maj. M. Gray Zalinski, acting Ch. Q. M., Omaha, Neb., for constructing 2 single set quarters for civilian employes and 1 double set quarters for non-commissioned staff officers at Ft. Crook.

Atlantic City, N. J.—Bids will be received by the Superv. Archt., Treas. Dept., Washington, D. C., Feb. 2 for the hot water heating of the U. S. Post Office at Atlantic City, as advertised in The Engineering Record.

Atlantic City, N. J.—It is reported that the Fire Comr. is preparing to erect a $100,000 fire station at Pacific and Pennsylvania Aves., and another at Pacific and Florida Aves.

Ft. Mott, N. J.—Bids will be received by Capt. Louis F. Garrard, Jr., Q. M. U. S. A., Delaware City, Del., on Feb. 6, for installing a steam heating plant in the Administration Bldg., at Ft. Mott, as advertised in The Engineering Record.

Tompkinsville, S. I., N. Y.—Bids will be received by Lieut. Col. Wm. T. Rossell, Corps Engrs., U. S. A., on Feb. 9, for erecting a coal shed, at Light House Depot, as advertised in The Engineering Record.

Albany, N. Y.—The Trus. of the Homœpathic Hospital, it is reported, are contemplating the erection, this spring, of a hospital, at a cost of about $65,000.

New York, N. Y.—L. A. Burke & Son, 401 W. 59th St., have secured the contract for erecting the public bath on Ave. A and 23d St. (bids opened Dec. 7) for $213,750.

Rochester, N. Y.—Mayor Bickford, in his message to the City Council, recommends the appointing of a committee to secure plans, specifications and estimates for a building to take the place of the present city hall, the cost to be about $50,000, and he also recommends the issuing of bonds to this amount for this purpose.

Plattsburgh Barracks, N. Y.—Bids will be received by Capt. T. B. Lamoreux, Q. M., U. S. A., Burlington, Vt., on Feb. 9, for constructing, plumbing, steam heating and electric wiring one band barrack at this post, as advertised in The Engineering Record.

Cincinnati, O.—The Co. Comrs. have authorized the Trus. of Longview Hospital to issue bonds in the sum of $50,000 for the installation of a new heating plant.

Sandusky, O.—B. J. McGory, Clk. Bd. Pub. Service, writes that bids will be received on Jan. 21 for erecting a detention hospital; probable cost $6,000.

Cleveland, O.—It is reported that the Military Com. of the Chamber of Commerce has approved the issue of $50,000 bonds to complete the Central Armory.

Youngstown, O.—The bond issue of $15,000 for the new detention hospital, has passed third reading in the City Council.

Toledo, O.—The Eastern Dist. of the Iowa synod of the Lutheran Church, is said to have under consideration the erection of a home for the aged people and have selected this city as the site. Probable cost, $25,000.

Chillicothe, O.—Bids will be received until Feb. 15 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for a low-pressure steam heating apparatus complete, for the U. S. Post Office, at Chillicothe.

Franklin, Pa.—Plans are being prepared for a $100,000 jail to be erected in Venango County.

Williamsport, Pa.—Edgar V. Seeler, Real Estate Trust Bldg., Philadelphia, Pa., it is stated, is the archt. for a $100,000 2-story library which is to be erected here of white marble, 139x75 ft., and is to be known as the John V. Brown Memorial Library.

New Castle, Pa.—The following are the bids opened on Jan. 10, by the Superv. Archt. Treas. Dept., Washington, D. C., for the construction of the U. S. Post Office at New Castle: Brady Constr. Co., Fairmount, W. Va., $94,514; The Stevenson Constr. Co., Dallas, Tex., $73,480; Thos. Reilly, Philadelphia, $76,902; A. & S. Wilson Co., Pittsburg, $84,675; M. Heintz Co., Cleveland, O., $96,150; Cramp & Co., Philadelphia, $76,078; Standard Constr. Co., Chicago, Ill., $70,760; Mankin Constr. Co., Richmond, $67,990; A. B. Stannard, New York, N. Y., $74,759; Wheaton Bldg. Co., Putnam, Conn., $85,250; Henry Shenk Co., Erie, $89,311; Constable Bros. Constr. Co., Erie, $85,750; Kendrick & Roberts, Philadelphia, $81,577; Richardson & Burgess, Washington, D. C., $70,921; Fissel & Wagner, New York, N. Y., $66,400; W. E. McGillick, Pittsburg, $104,150; Henderson & Co., Philadelphia, $78,827, and Chas. McCaul Co., Philadelphia, $71,996.

Greenville, S. C.—The erection of a new city hall at a cost of about $35,000 is reported under consideration.

Lewisburg, Tenn.—The County Court has decided to erect a new jail at a cost of about $10,000, and has appointed a committee to select a site.

Lawrenceburg, Tenn.—The County Court has selected plans and will erect a new court house at a cost of $20,000.

*_Hartsville, Tenn._—W. R. Harper, of Cleveland, Tenn., it is reported, has received the contract to erect the court house, at $15,500.

Jamestown, Tenn.—The County Court, it is reported, is about to petition the Legislature for permission to issue $15,000 bonds to erect a court house to replace the structure which was destroyed by fire.

Ft. Sam Houston, Tex.—Bids are wanted Jan. 14 for alterations and plumbing in Central building at this post. Robt. R. Stevens, Ch. Q. M., San Antonio.

*_Norfolk, Va._—The Penn Bridge Co., of Beaver Falls, Pa., it is reported, has received the contract to erect 2 medical officers' quarters at the Marine Hospital here, at $17,947. The Common Council has voted to authorize the Finance and Market Committees to have plans prepared for a market-house, to cost approximately $40,000.

Burlington, Vt.—Mayor Burke, it is stated, is advocating the erection of a new city hall at a probable cost of $125,000.

*_Aberdeen, Wash._—P. F. Clark, City Clk., writes that the contract for erecting the superstructure of a 2-story City Hall 192x200 ft. (bids opened Dec. 28) has been awarded to W. H. White, of Aberdeen, for $23,540, not including steam heating, the contract for which has not yet been let. Foundation is already constructed.

Spokane, Wash.—Preusse & Zittel, Jameson Bldg., it is reported, have completed preliminary plans for the armory which is to be erected at Riverside Ave. and Jefferson St.

Hamilton, Ont.—The citizens on Jan. 2 voted in favor of raising $50,000 for erecting an addition to the hospital, and $15,000 for market improvements.

Chatham, Ont.—The citizens on Jan. 2 voted in favor of erecting a market building, at a cost of $41,000.

BUSINESS BUILDINGS.

*_Huntsville, Ala._—W. J. Bennett & Co., it is reported, have the contract for the excavating, and Glidwell Bros., of Fayetteville, Tenn., the general contract for Terry Bros. & Rodgers department store which is to be erected at Clinton and Washington Sts., at a cost of $23,000.

*_Santa Monica, Cal._—H. H. Goetz, of Santa Monica, it is reported, has received the contract to erect a bank building at 3d and Oregon Sts., which is to cost about $22,000.

Sawtelle, Cal.—It is reported that the Odd Fellows Bldg. Co. has been incorporated, with a capital of $25,000, for the purpose of erecting a lodge building. G. H. Smith is one of the directors.

Denver, Colo.—Murto & Humphreys will erect a business block, to cost $50,000

Washington, D. C.—Lodge No. 15 of the Benevolent and Protective Order of Elks, of Washington, it is reported, has secured a site at 919 H St., n. w., and will erect thereon a club-house, at a cost of about $300,000. It is reported that plans are being prepared, and that the work of construction will be pushed as rapidly as possible. M. G. McCormick, Treas. of the Local Order of Elks, may be able to give further information.

Chicago, Ill.—The Illinois Tunnel Co., it is reported, has purchased the site at Taylor St. and Stewart Ave., and intends erecting a 12-story warehouse, 200x700 ft., at a cost of about $100,000.

Otto Young, it is stated, will erect for Carson, Pirie, Scott & Co., a 12-story addition to its building on State St., which is to cost about $800,000.

Morton J. Stevenson, Andrew McAnsh, and others, are reported interested in the erection of a clubhouse on Diversey Boule. and N. Clark St., for the Lake Shore Club.

The Oriental Consistory of Scottish Rite Masons, it is reported, has placed a loan of $50,000 for rebuilding their quarters on Dearborn Ave. and Delaware Place.

Francis M. Barton is preparing plans for a store and flat building, to be built at W. Madison St. and Homan Ave., by Dr. Antonio Lagorio. The building will be 3 stories high, 200x125 ft., and cost $75,000.

Howard Shaw, 175 Dearborn St., it is stated, is the architect for a commercial building to be erected by Philo A. Otis, at Michigan Boul. and 12th St. It will be 3-stories high, of brick and mill construction, 50x145 ft., and cost $25,000.

Highland Park, Ill.—The members of the Exmoor Golf Club at Highland Park have abandoned the project of building a new clubhouse, and will rebuild the old structure, which was damaged by fire, according to plans prepared by Ernest A. Mayo, 204 Dearborn St., Chicago, the cost to be about $35,000.

East Germantown, Ind.—The I. O. O. F., it is reported, have purchased a site and will erect a 2-story brick and stone building.

Estherville, Ia.—H. C. Coon, it is stated, has decided to erect a 2-story building at a cost of $30,000.

Sioux City, Ia.—See "Railroads."

Sioux City, Ia.—J. P. Eisentraut, Metropolitan Blk., it is reported, is preparing plans for a 2-story brick store and hotel building to be erected on Pearl St., for F. L. Hagan, at a cost of $18,000.

G. W. Burkhead, Iowa Savings Bank Bldg., it is reported, has been commissioned to prepare plans for a 4-story and basement, 100x100-ft. brick, terra cotta and stone store and office building, which is to be erected by D. T. Gilman at a cost of $35,000. He has also been commissioned to prepare plans for a 3-story and basement building to be erected at 610 4th St., by the Val Blatz Brewing Co., at a cost of $20,000.

Council Bluffs, Ia.—The implement warehouse of the Fuller & Johnson-Shugart Co., which was destroyed by fire on Dec. 27, is to be rebuilt.

Eldorado, Kan.—The Santa Fe. Ry. Co., it is reported, will erect a depot of brick and stone in this city. It is to be heated by steam and lighted by electricity. H. U. Mudge, Gen. Mgr., Topeka, Kan.

Olathe, Kan.—It is reported that business buildings on the public square were destroyed by fire on Jan. 10, including the telephone and telegraph offices and the post office.

Louisville, Ky.—It is stated that plans have been completed for a 14-story office building to be erected on 4th Ave., at a cost of $1,000,000. Brinton B. Davis, of Paducah, is reported to be the archt.

New Orleans, La.—The 5-story warehouse and annex on 420 Common St., owned by Dwyer Bros., it is reported, was destroyed by fire Dec. 28.

*_Baltimore, Md._—The Chas. McCaul Co., of Philadelphia, Pa., it is reported, has received the contract to erect a 4-story, 100x60-ft. warehouse for W. C. Nimo, at 109 Cheapside St., at a cost of $25,000.

Archer & Allen have been commissioned by R. Brent Keyser to prepare plans for a 5-story and basement brick building, to be erected at 27 W. Baltimore St.

*Howard Davis, it is reported, has awarded the contract to erect a 5-story building on N. Charles St. to Thos. B. Stanfield & Son, the cost to be about $40,000. Ellicott & Emmart, of Baltimore, are the archts.

*B. F. Bennett, of Baltimore, it is reported, has the contract for a 2-story 67x93 ft. brick and stone fireproof warehouse, to be erected at 418 Pratt St., for Frank Brown. Henry Brauns, of Baltimore, is the archt.

*_Holyoke, Mass._—The contract to erect the 2-story, 100x125-ft. brick mill building for Buchanan, Bolt & Co., it is reported, has been awarded to Casper Ranger, 10 Bond St., at about $20,000. G. P. B. Alderman & Co., of Holyoke, are the archts.

Manistee, Mich.—John O. Nessen, of Manistee, will erect a 4-story brick block, 60x80 ft., on River and Oak Sts., to be occupied by the Elks' Lodge. No plans prepared yet.

St. Paul, Minn.—The Orpheum Circuit Co., it is reported, has announced that it intends erecting a fireproof theater in this city. Martin Beck, Gen. Mgr. of the Company, 504 Ashland Blk., Chicago, Ill.

Minneapolis, Minn.—A 5-story building is to be erected by Boutell Bros. according to plans prepared by Sedgwick & Saxton, Lumber Exchange. Pike & Cook, 224 S. 4th St., are the builders.

*_St. Joseph, Mo._—The South Park Grain Co., it is stated, has awarded the contract to erect a $40,000 grain elevator on the Burlington tracks, near S. 6th St., to Younglove & Boggess Co., of Mason City, Ia. It is to have a capacity of 100,000 bushels.

Kansas City, Mo.—L. N. Leslie will erect a brick office building on Baltimore Ave. and 10th St., to cost about $150,000.

Havre, Mont.—The Great Northern Ry. Co. is reported to be considering the erection this season of a new depot and offices at Havre. A. H. Hogeland, Ch. Engr., St. Paul, Minn.

Lincoln, Neb.—It is reported that plans have been prepared for remodeling the Burlington depot in this city, at a cost of about $30,000. I. S. P. Weeks, Ch. Engr., Div. West of the Missouri, Lincoln.

Berlin, N. H.—Fire in this city on Jan. 4, it is reported, destroyed the Clement Opera House block, the Gagnon block and Thorndike Hotel.

Union Hill, N. J.—Fredk. Klein, of the insurance firm of Meyer & Klein, Lincoln Trust Co. Bldg., Jersey City, is reported interested in the erection of a theater on Bergenline Ave. and Franklin St., Union Hill, at a cost of about $125,000. J. B. McElfatrick & Son, 1402 Bway., N. Y. City, are reported to be the archts. for the building.

Jersey City, N. J.—The 4-story brick factory building owned by the Elysian Supply Co., it is reported, was totally destroyed by fire Jan. 3.

Elizabeth, N. J.—It is reported that the members of the Y. M. C. A. are contemplating the erection of a 4-story brick building at E. Jersey and Broad Sts., at a cost of $60,000. Calvin B. Orcutt is a member of the Bldg. Com.

Lestershire, N. Y.—The Golden Sceptre Lodge, I. O. O. F., it is reported, is contemplating the erection of a temple on Main St.

New York, N. Y.—The members of the Automobile Club of America, it is reported, have adopted resolutions authorizing the Bd. of Governors to secure a site and proceed with the erection of the new building, also giving them power to organize a construction company to carry on the work. Albert R. Shattuck, is Chmn. of the Bldg. Com.

Wilmington, N. C.—Hook & Sawyer, of Charlotte, have prepared plans for a $30,000 theater which, it is stated, is to be erected on 2d and Princess Sts. by S. A. Schloss, of this city, and others.

Toledo, O.—It is stated that the officials of the Commercial Bank are contemplating the erection of a building at Main and 2d Sts., to cost about $30,000. David Harpster, Pres.

Local press reports state that Gen. C. M. Spitzer has decided to abandon the erection of the proposed 16-story building which was to be known as the "Nicholas," as the bids recently received for its construction were too high, and it is reported he will erect instead an arcade either 2 or 5 stories high.

Fostoria, O.—It is reported that a stock company has been organized for the purpose of erecting a $70,000 hotel at Main and South Sts. E. W. Allen may be able to give further information.

Cincinnati, O.—It is reported that the owners of the Cincinnati "Post" intend erecting a building on Elm St., at a cost of about $300,000. A. M. McRae, Mgr.

Sandusky, O.—Daniel Kunz is said to be interested in the erection of a theater in this city, at a cost of about $30,000.

Cleveland, O.—The Euclid Opera House Co., it is reported, will make improvements to the Euclid Ave. Garden Theater, at a cost of $20,000. Harry D. Kline, Bus. Mgr.

Guthrie, Okla. Ter.—J. Foucart, of Guthrie, it is reported, has been authorized to prepare plans for a 2-story business block which C. A. Filsch intends erecting at Oklahoma Ave. and Division St., at a cost of $15,000.

Pittsburg, Pa.—The general storehouse and time keeper's office of the Pressed Steel Car Co., at Schoenville, it is reported, was destroyed by fire on Jan. 9.

*_Philadelphia, Pa._—The Thompson-Starrett Co., of N. Y. City, it is reported, has received the contract to erect a 6-story power building for John Wanamaker in the rear of 1224 Market St. D. H. Burnham & Co., of Chicago, Ill., are the archts.

*Armstrong & Latta, it is reported, have been granted a permit to erect a 7-story addition on the Chestnut St. side of the Merchants' Warehouse Co.'s building, at a cost of $195,000. G. W. & W. D. Hewitt, Bulitt Bldg., are the archts.

Charleston, S. C.—It is reported that the Atlantic Coast Line and Southern Ry. Companies have purchased a site at Columbus and Bay Sts., and will erect a union station. D. W. Lum, Ch. Engr., Main. of Way and Structures of the Southern Ry., Washington, D. C.

Knoxville, Tenn.—The officials of the Mechanics National Bank are said to be interested in the erection of a 10-story office building on Gay St. S. B. Luttrell is one of the officials.

The Walla Walla Gun Co., it is stated, will erect a 4-story factory on Park Ave., to cost $15,000.

Memphis, Tenn.—Davitt & Moriarty, it is reported, will erect a store and flat building, at a cost of $18,000, on Main and Talbot Sts.

The Trus. of the Wood estate, at 19 Madison St., it is reported, are about to have plans prepared by Chighizola & Hanker, Randolph Bldg., for a 3-story brick building which it is proposed erecting, at a cost of $20,000.

Alsup & Woods, 544 Randolph Bldg., it is stated, are preparing plans for 2 buildings, each 5 stories high, of brick with stone trimmings, which are to be erected on Union and 2d Sts., at a total cost of $200,000.

Dallas, Tex.—The directors of the Methodist Publishing House at Nashville, Tenn., it is reported, are considering the erection of a publishing house in this city, at a cost of about $100,000. Dr. B. H. Lamar is one of the Mgrs. of the Nashville house.

A building permit has been granted to the Emerson Mfg. Co. for the erection of a 5-story brick building, 44x100 ft., which is to be erected on Pacific Ave., at a cost of $20,000.

Waco, Tex.—The citizens have subscribed $25,000 toward the erection of a Y. M. C. A. building at Washington and N. 6th Sts.

Houston, Tex.—A building permit has been granted to the Holland Lodge, No. 1, of the Order of Masons to erect a 3-story building on Main and McKinney Sts., to be used as a lodge hall and store, and to cost $30,000.

Salt Lake City, Utah.—The Eastern Hotel Co., of Boston, Mass., it is reported, is contemplating the erection of an 8-story fireproof hotel which is to be erected on Main St. at a cost of about $500,000. R. E. Marx is the local representative of the company.

Rutland, Vt.—Geo. C. Underhill, of this city, is reported interested in the erection of an 8-story office building and theater here at a cost of $200,000.

Norfolk, Va.—Ferguson & Calrow, of Norfolk, are preparing plans for a 6-story and basement brick and terra cotta hotel which is to be erected at Granby and Tazewell Sts. by a syndicate, of which C. N. Whitehurst is a member. Probable cost, $125,000.

*E. Tatterson, Columbia Ave., it is reported, has received the contract to erect a $17 000 building for the Allyn estate.

*Items marked thus give the names of parties awarded contracts.

oanoke, Va.—L. E. Johnson, Pres. of the folk & Western R. R. at Roanoke, it is re- ted, has announced that an office building to be erected in this city, at a cost of ut $112,000.

ynchburg, Va.—It is reported that the Di- tors of the Y. M. C. A. are contemplating erection of a building, at a cost of $50,- .

Spokane, Wash.—R. K. Neil will erect a tory brick hotel, 101x79 ft., to cost $35,- 0. Architect, L. L. Rand, 518 Rookery lg.

L. L. Rand is the architect for a 3-story ilding, 42x100 ft., for S. Heath, to cost 5,000.

Bellingham, Wash.—Roehl Bros. and Mrs. argaretta Farning, it is reported, are ne- tiating for a site at Elk and Holly Sts., d, it is stated, will erect a 5-story building the site.

Chester, W. Va.—It is reported that the ant of the American Tinplate Co. is to be larged by the erection of 2 buildings, each x90 ft. to cost $50,000.

Milwaukee, Wis.—C. J. Dixon, it is report- d, has purchased a site at Milwaukee and uron Sts., and will erect a building, at a ost of $60,000.

Emerson, Man.—It is reported that an in- ernational depot is to be erected here by he Great Northern (A. H. Hogeland, Ch. ngr., St. Paul, Minn.), the Canadian Paci- c (W. F. Tye, Ch. Engr., Montreal, Que.), he Canadian Northern (A. Wilcox, Supt., Vinnipeg, Man.), and the Soo Line (Thos. reene, Ch. Engr., Minneapolis, Minn.). In ddition to being a railway depot, it is to e used as a custom house by both govern- ents.

Chihuahua, Mex.—See "Power Plants, Gas nd Electricity."

NEW YORK, N. Y.

Delancey and Sheriff Sts, 7-story br and tone store and loft bldg; c, $30,000; o, Hup- ert & Bernstein; a, Bernstein & Bernstein.

32 Lewis St, 7-story br and stone stable and loft bldg; c, $22,000; o, L Aronowitz; a, C Dunne.

120 W 31st St, 7-story br and stone store and loft bldg; c, $75,000; o, O H Olsen; a, C A French.

421 E 90th St, 6-story br and stone stable and loft bldg; c, $50,000; o, Seitz Realty Co; a, Horenburger & Straub.

3d Ave and 85th St, 4-story br and stone bank and office bldg; c, $125,000; o, Yorkville Bank; a, Robt Maynicke.

Rider Ave and 144th St, 4-story br shop and loft bldg; c, $16,000; o, Kate Haiss; a, Geo Haiss Mfg. Co.

Westchester and Prospect Aves, 2-story br stores and offices; c, $60,000; o, Fred Johnson; a, J E Scharsmith.

33 E 21st St, 10-story br and stone extension to 10-story br and stone storage bldg; c, $250,000; o, Jeremiah W McDonald and Geo D Wick; a, D H Burnham.

111 W 38th St, alterations to 7-story br and stone office bldg; c, $16,750; o, N Y Telephone Co; a, Eidlitz & McKenzie.

CHURCHES AND DWELLINGS.

Denver, Colo.—The Trus. of the Trinity Episcopal Church, it is reported, are considering the erecting of an edifice, at a cost of $35,000. Rev. Pelham Williams, Pastor.

Peoria, Ill.—Parr & Hulsebus, Y. M. C. A. Bldg., have completed plans for a brick and stone apartment house which is to be erected on Fayette St., by Chas. E. Gray, at a cost of $25,000.

**Jacksonville, Ill.*—It is reported that Arbogast & Ballard, of Mattoon, have received the contract to erect an edifice for the First Christian Church, which is to cost about $50,000.

Assumption, Ill.—It is reported that plans have been completed for an edifice which is to be erected by the congregation of the Methodist Episcopal Church, at a cost of $20,000.

Chicago, Ill.—It is stated that a memorial chapel is to be erected for the Grace Episcopal Church by Mrs. W. G. Hibbard; estimated cost, $30,000.

Peru, Ind.—It is reported that plans have been approved for a new edifice for the Presbyterian Church which is to be erected of stone and is estimated to cost about $50,000.

Louisville, Ky.—Chas. D. Meyer, Keller Bldg., is preparing plans for a 5-story brick apartment house which is to be erected on 4th Ave., at a cost of $60,000.

New Orleans, La.—The members of the First Baptist Church, it is reported, have decided to erect a new edifice, at a cost of between $30,000 and $40,000. Rev. C. V. Edwards, Pastor.

**Baltimore, Md.*—Jas. Stewart & Co., it is reported, has received the contract to erect a brick, terra cotta and concrete apartment house for the Walter R. Abell estate at Lafayette Ave. and Charles St., which is to cost about $180,000. Wyatt & Nolting, of Baltimore, are the archts.

Detroit, Mich.—It is reported that A. C. Varney & Co., 58 Newberry Bldg., are the archts. for a flat which is to be erected by Cyrus Boss on Ferry and Woodward Aves., at a cost of $15,000.

St. Louis, Mo.—It is reported that the congregation of the Second Baptist Church has $100,000 available for the erection of an edifice. F. H. Ludington, Chmn. Bldg. Com.

Kansas City, Mo.—The E. Whyte Estate will erect at 1200-2 E. 11th St., brick apartments, to cost $30,000.

Omaha, Neb.—It is reported that plans are being prepared for a new edifice for the Lowe Ave. Presbyterian Church, which is to be erected at a cost of $18,000. Address Pastor.

Bayonne, N. J.—John J. Schmidt, 352 Ave. C, it is stated, has prepared plans for a 4-story brick flat to be erected on Ave. C and 19th St., by Wm. Goodman, of Ave. C and 18th St., at a cost of $24,000.

West New York, N. J.—John G. Helmers, 431 N. Y. Ave., Jersey City, it is reported, is preparing plans for a flat which is to be erected by Frank Pace at Bergenline Ave. and 17th St., at a cost of $12,000.

Bayonne, N. J.—John J. Schmidt, 352 Ave. C, it is stated, is preparing plans for a 3-story brick flat which is to be erected on Ave. C. It is reported that bids will be received by the owner, Todres Nalitski, 36 W. 22d St., until Jan. 31 for erecting the building.

Montezuma, O.—Bids are wanted Feb. 1 for erecting brick church near Montezuma. Address Rev. A. C. Tabke, Chickasaw.

Dayton, O.—It is reported that plans are being prepared for a $50,000 edifice, which is to be erected for the First United Brethren Church. W. J. Shuey, Secy.

Marietta, O.—It is reported that the Trus. of the First Baptist Church are contemplating the erection of a new edifice at 4th and Putnam Sts., to cost $20,000. Address Pastor.

Pittsburg, Pa.—R. Maurice Trimble, Ferguson Bldg., is preparing plans for a residence which is to be erected by M. Taylor on H St., at a cost of about $30,000.

*The Scott-Krieble Constr. Co., it is reported, has received the contract to erect the 6-story apartment house at Penn and Homewood Aves., at a cost of about $140,000. E. J. Schellentrager, 309 4th Ave., is reported to be the archt.

Jefferson City, Tenn.—The members of the First Baptist Church have decided to erect a new edifice at a cost of about $12,000. Dr. M. D. Jefferis is a member of the Bldg. Com.

**Chattanooga, Tenn.*—A building permit has been granted to Ross Faxon to erect a dwelling on Bluff View, at a cost of $25,000. Garrity-Hahn Bldg. Co., of Knoxville, Builders; Abraham Garfield, Archt., Garfield Bldg., Cleveland, O.

Milwaukee, Wis.—E. Brielmaier & Sons, 602 2d St., are said to be the archts. for an edince which is to be erected by the congregation of St. Laurentius Church, at a cost of about $25,000.

**Milwaukee, Wis.*—A building permit has been granted to E. A. Uhrig to erect a 3-story, 53x73-ft. residence on Wyoming Pl. and Lake Drive, at a cost of $35,000. John Langenberger, 317 Wells St., has the contract for the carpenter work, and F. F. Jones, the contract for the mason work.

NEW YORK, N. Y.

286 Spring St, 6-story br and stone tenemt; c, $30,000; o, Empire City Realty Co; a, L A Goldstone.

334 E 114th St, 6-story br and stone tenemt; c, $60,000; o, Morris Fine; a, Bernstein & Bernstein.

320 W 84th St, 6-story br and stone tenemt; c, $60,000; o, Rosenberg & Feinberg; a, Edward A Meyers.

139th St and 5th Ave, 3 6-story br and stone tenemts; total c, $150,000; o, Nathan Navasky; a, Bernstein & Bernstein.

140th St and Lenox Ave, 3 6-story br and stone tenemts; total c, $120,000; o, Rosalia Meli; a, Louis C Maurer.

Lenox Ave and 140th St, 6-story br and stone tenemt; c, $55,000; o, McKinley Realty & Constr. Co; a, John Hauser.

163d St and Melrose Ave, 6-story br tenemt; c, $45,000; o, Moorehead Realty Co; a, Harry T Howell.

Longwood Ave and Hewitt Pl, 5 5-story br tenemts; total c, $162,000; o, Geo C Edgar's Sons; a, Turner & Killian.

24 E 62d St, 4-story br and stone extension to 4-story br and stone dwell; c, $35,000; o, Thos J Lonigan; a, C P Karr.

SCHOOLS.

**Orange, Cal.*—It is reported that the following are the bids received for erecting the Union High School: Geo. Preble, Tustin, $25,493; Kuechel & Black, Santa Ana, $26,730; C. McNeil, Santa Ana, $25,690; C. H. Smith, Fullerton, $25,600; F. A. Noyes, San Bernardino, $24,345; R. J. Noble, Long Beach, $24,300 (contract awarded) and J. T. McClellan, Orange, $25,859.

San Francisco, Cal.—See "Sewerage and Sewage Disposal."

Los Angeles, Cal.—It is reported that the plans recently adopted for the high school are to be abandoned and a new set of plans prepared, the cost of the building to be kept within the appropriation, which is $30,000.

Pueblo, Colo.—The plans for the Central High School, as prepared by Robt. S. Roeschlaub & Son, 52 King Blk., Denver, provide for a 4-story 330x142 ft. building, which is to be erected at Orman and Grant Aves. and B'way and Michigan St., and is to cost, including equipment about $400,000.

New London, Conn.—The Trus. of the New London Manual Training and Industrial School have accepted the report of the Bldg. Com., in which the plans of Donnelly & Hazeltine, 94 State St., have been accepted for the new school, which is to be of brick with limestone trimmings, and cost about $50,000. It is reported that bids for erecting the building will soon be asked. Fredk. S. Newcomb is a member of the Bldg. Com.

Aurora, Ill.—It is reported that bids will be asked at once by the School Bd., for erecting a $50,000 school. Patton & Miller, of Chicago, are the archts.

Chicago, Ill.—Plans for the new Graham school at 45th St. and Union Ave. have been completed by R. B. Williamson. It will be a 3-story structure of fireproof construction, and contain 20 classrooms and an assembly hall, and is estimated to cost $155,000.

Murphy & Camp, Fisher Bldg., have made plans for a R. C. parochial school, 3-story, to be erected at Whipple and School Sts., for the Rev. Father Theodore Burke; cost, $50,000.

Henry J. Schlacks, 109 Randolph St., is preparing plans for a 3-story parochial school and hall building to be built in Rogers Park for St. Jerome's R. C. congregation, at a cost of $40,000.

Ft. Wayne, Ind.—Bids will be received Jan. 28, by the Bd. School Trus., for $125,000 school bonds. Chas. B. Bash, Chmn.

Ames, Ia.—Bids will be received Jan. 26, by the Bd. Trus., Iowa State College, (E. W. Stanton, Secy.) for erecting central heating station for dairy. Proudfoot & Bird, Archts., 712 Crocker Bldg., Des Moines.

Fall River, Mass.—The following bids, it is reported, were received Dec. 29 for a ventilating and heating apparatus in the Eastern Ave. school: Stetson & Lord—Tubular boiler, $5,762. John F. Johnston Co., 371 Central St.—Tubular boiler, $4,057; Gurney boiler (sectional), $699 extra; Mercer boiler, $313 extra. W. H. & J. F. Whalon—Tubular boiler, $5,907. William Kennedy—Tubular boiler, $5,907, or $6,210 with pipes covered; Gurney boiler, $590 extra. J. H. Gildard—Tubular boiler, $5,641; Gurney boiler, $925 extra; Furman boiler, $5,684. Henry Lagasse—Tubular boiler, $5,528; sectional boiler, $5,678.

Bids opened at the same time for plumbing in said building were submitted by Wm. Kennedy, at $3,431, and J. F. Johnston & Co., 371 Central St., at $3,299.

New Bedford, Mass.—School bonds amounting to $50,000 are reported sold.

Salem, Mass.—Plans submitted by Kilham & Hopkins, of Boston, for the high school have been accepted. They provide for a 3-story and basement brick and stone structure, 150x240 ft.

Tufts College, Mass.—Andrew Carnegie has given to Tufts College, $100,000, with which to erect a college library.

Dorchester, Mass.—The Schoolhouse Comn. at Boston, it is stated, has accepted plans prepared by Jas. E. McLaughlin, for a 10-room primary school, to be erected of red brick, at McLellan and Glenway Sts., in Dorchester.

Quincy, Mass.—An order has been introduced in City Council for $65,000 to enlarge the High School, from plans of Aaron A. Gould, of Boston. Hamilton Flood, City Engr.

Ann Arbor, Mich.—The high school, which was recently destroyed by fire is to be rebuilt at a cost of about $150,000, under the direction of the School Board, of which M. J. Cavenaugh is Pres.

Grand Rapids, Mich.—The erection of an addition to the Union School, at a cost of about $10,000, and to the Central High School, at a cost of about $25,000, is under consideration.

Halstad, Minn.—Bids are wanted Feb. 8, for erecting a high school; bids for plumbing to be submitted separately. H. D. Nygaard, Secy. School Bd.

Columbia, Miss.—The erection of a school at a cost of about $30,000 is under consideration.

Newark, N. J.—Mayor Doremus in his annual message to the City Council recommends that another high school be erected.

Hoboken, N. J.—Mayor Lankering in his message recommends the erection of a 14-room school in the 4th Ward, and a new High School, to be used for grammar school purposes also.

Millville, N. J.—The erection of a school to replace the Culver School is being agitated.

Kearny, N J.—John B. Warren, 22 Clinton St., Newark, it is reported, has submitted to the Bd. of Educ., plans for a 4-room addition to School No. 5, to cost about $11,000.

Princeton, N. J.—The alumni of the classes between 1892 and 1902, it is reported, have donated $100,000 with which to erect a dormitory on Brokaw Field. It is stated that plans have been prepared for the building by Benj. Morris, 5 W. 31st St., N. Y. City.

**Brooklyn, N. Y.*—The following are the bids opened on Jan. 9, by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing ventilating and heating apparatus in school No. 103, Brooklyn Boro.: E. Rutzler Co., 178 Centre St., N. Y. City, $20,425 (awarded contract); Rossman & Bracken Co., $21,000; Frank Dobson, $21,888; James Curran Mfg. Co., $21,500; George A. Suter, $20,712, and United Htg. Co., $21,421.

*Jas. I. Neman has secured the contract for erecting iron stairways at Boys' High School, (bids opened Jan. 9) for $3,265.

Bids will be received Jan. 23, by C. B. J. Snyder, Supt. School Bldgs, N. Y. City, for erecting, including plumbing and drainage, school No. 151.

New York, N. Y.—Plans have been filed by C. B. J. Snyder, Supt. of School Bldgs., for 2 schools which are to be erected under the Williamsburg Bridge, in Manhattan Boro., and to be known as Temporary Schools Nos. 7 and 8. They are to be 1-story brick structures, one 200x30 ft., and the other 167x96 ft., and to cost $14,000 and $25,000, respectively.

Bids will be received Jan 23, by C. B. J. Snyder, Supt. School Bldgs., for erecting outside iron stairs at school No. 56, Boro. Manhattan.

Albion, N. Y.—The erection of a Medina stone school at a cost of about $10.000 is reported under consideration.

Canandaigua, N. Y.—Bids will be received until Feb. 4 by Frank J. Sleght, Clk. Bd. Edu., for furnishing material and erecting an Academy Building on Main St. The bids are to include heating, plumbing and electric work. Probable total cost, $80,000. Wilson Potter, 3 Union Sq., N. Y. City, is the archt.

Carthage, N. Y.—Plans prepared by Eaton & Brownwell, have been approved by the State Bd. of Educ., for a 2-story brick school which it is proposed erecting in West Carthage, at a cost of $28,000, and an election is to be held Jan. 16 to vote on the question of issuing bonds to this amount for this purpose.

Troy, N. Y.—The Bd. of Trus. of the Rensselaer Polytechnic Institute, it is reported, have decided to have plans prepared for the main building of the Institution which is to be erected on Bway, and to rebuild in the spring. The erection of a chemical laboratory at a cost of about $80,000 is being considered.

Bolivar, N. Y.—J. Mills Platt, Archt., of Rochester, writes that bids will be received about Feb. 8 for the erection of a school here, to cost $23,000.

Cincinnati, O.—Local press reports state that the School Bd. has adopted a resolution to employ an archt. to prepare plans for a school to be erected on the White St. site in the 24th Ward, at a cost of $100,000.

Preliminary plans have been completed for the $50,000 dormitory which is to be erected for male students at the God's Bible School, on Young St., Mt. Auburn.

Elyria, O.—Plans prepared by H. O. Wurmser, of Lorain, for the $25,000 school to be erected here have been accepted.

Delaware, O.—The Trus. of the Wesleyan Univ., it is reported, are contemplating the erection of an annex to the Univ. for engineering purposes, at a cost of $10,000.

West Chester, Pa.—The School Directors have decided to erect a high school this year, at an estimated cost of between $50,000 and $60,000.

Pittsburg, Pa.—Dean & Stophlet, 331 4th Ave., it is reported, have been engaged to prepare plans for a 3-story $40,000 addition to the 21st Ward School, which is to be erected at Hamilton and Lane Aves.

McKeesport, Pa.—Bids will be received Jan. 16, by C. P. Fiedler, Secy. School Bd., for $254,000 school bonds.

Annville, Pa.—Pres. Hervin U. Roop, of the Lebanon Valley College, it is reported, has announced that he has received an offer from Andrew Carnegie to give $50,000 to the College, on condition that a like sum is raised in addition to the insurance which was received through the recent fire, the total, a sum of about $145,000, to be used to rebuild and enlarge the College.

North Augusta, S. C.—The erection of a school at a cost, including furnishing of about $12,000, is reported under consideration.

Lac du Flambeau, Wis.—Bids will be received Feb. 7 by F. E. Leupp, Comr. Indian Affairs, Dept. Interior, Washington, D. C., for furnishing material and constructing dormitory, addition to school and additions to heating, water and sewer systems at Lac du Flambeau Boarding School. For further information, apply to S. W. Campbell, U. S. Indian Agent, Ashland.

Delavan, Wis.—It is reported that plans are being prepared for a $50,000 school.

STREET CLEANING AND GARBAGE DISPOSAL.

Manchester, Conn.—Press reports state that bids will soon be asked by the Bd. of Selectmen for the collection and disposal of garbage.

Chicago, Ill.—The Council Finance Com. has recommended that the Council permit the advertising for bids for the disposal of refuse.

The E. E. Hill Refuse Incinerating Co., of Chicago, has been organized, with a capital of $500,000. The company is stated to have submitted to the Finance Committee of Council a proposal for the erection of garbage plants of 100 tons capacity per day, for $35,000.

**Ft. McKinley, Me.*—Capt. A. W. Yates, Q. M. U. S. A., Portland, writes that the Municipal Eng. Co., of New York, N. Y., has secured the contract for erecting a crematory complete, including the building at Ft. McKinley (bids opened Dec. 7).

Lowell, Mass.—H. H. Knapp, Agent Bd. of Health, writes that it is proposed to construct a garbage crematory for paper and dry refuse with meat and fish market waste; appropriation, $10,000.

Items marked thus give the names of parties awarded contracts.

Grand Rapids, Mich.—The Dixon Garbage Crematory Co. is stated to have submitted to the Bd. of Health plans for overhauling or rebuilding the local garbage burner. It estimates the cost at $15,776. The plans provide for two new Dixon 35-ton furnaces, also a slight remodeling of present building.

Plainfield, N. J.—Chas. J. Fisk, Pres. Health Bd., in his anual report to Council, is reported to have recommended the inauguration of a municipal system of garbage collection and disposal.

Toledo, O.—The Bd. of Pub. Service is reported to have about decided to ask Council to construct a garbage disposal plant.

NEW INDUSTRIAL PLANTS.

The Pittsburgh Transformer Co., Barker Place, Pittsburg, Pa., is in the market for one 3-ton hand-power traveling crane of 15-ft. span, one two-phase motor and a small blower or air compressor.

For ice plant at Oxford, N. C., see "Power Plants, Gas and Electricity."

The Davidson Fruit Co., Hood River, Ore., will erect a 2-story, 40x120-ft. brick building and install a 15-ton refrigerating machine.

The Capital Compress Co., Austin, Tex., will erect a cottom compress to have a daily capacity of 1,100 bales.

For refrigerating and ice plant at Indio, Cal., see "Power, Plants, Gas and Electricity."

The Chattanooga, Tenn., Cooperage & Lumber Co., expects to add planing mill machinery to its plant, and will probably need a 100-hp. engine and a 125-h.p. boiler.

John M. Mueller, Jr., proprietor of the Standard Marble Works, Cincinnati, O., writes that he cannot at present give size of building he intends to erect to replace that recently burned.

The Southern Biscuit Works, Richmond, Va., contemplate establishing a bakery at Memphis, Tenn., and are considering plans and specifications.

The Kessler Machine & Supply Co., 416-436 Sixth St., San Diego, Cal., contemplates installing a lighting plant.

The Hogeland-Barrett Mfg. Co., 436 Lemcke Bldg., Indianapolis, Ind., will build a plant for making automatic high-water-pressure check-valves. Bids are being received for a 100x225-ft. brick building.

The Standard Self-Filling Fountain Pen Co., 619 Spitzer Bldg., Toledo, O., will require a motor and several lathes.

The Wellington Starch Co., Lititz, Pa., is having plans prepared for a plant at Marion, Ind., which will require about 2,000 h.p. in boilers, and about 1,200-h.p. engine. Five buildings will be erected, the sizes of which have not been decided. The plant will have a capacity of 5,000 bu. corn daily, for the manufacture of starch and glucose.

The Duluth, Nissabe & Northern Ry. Co. will erect machine shops at Proctor, Minn., contracts for which have not yet been let. W. G. Wallace, Supt. Motive Power and Cars.

MISCELLANEOUS.

Los Angeles, Cal.—Bids will be received at the office of the U. S. Reclamation Service, 1108 Braly Bldg., Los Angeles, on May 15 for the construction of Laguna dam and sluice ways, involving the excavation of 282,000 cu. yd. earth, 305,000 cu. yd. solid rock, placing 305,000 cu. yd. rock in dam and masonry core walls, building 27,150 cu. yd. concrete, laying 80,000 sq. yd. paving and 53,000 lin. ft. sheet piling for diversion of part of Colorado River, 10 miles n. e. of Yuma, Ariz., as advertised in The Engineering Record.

San Francisco, Cal.—Bids will be received by the California Debris Comn., Flood Bldg., on Feb. 3 for furnishing and driving piles, etc., for Barrier No. 1, Yuba River, Cal., as advertised in The Engineering Record.

**Montrose, Colo.*—The contract for constructing the Gunnison Tunnel and approaches (bids opened Oct. 5 by the U. S. Geological Survey at Montrose) has been awarded to the Taylor-Moore Constr. Co., Hillsboro, Tex., for $1,008,500. For detailed list of bids received for this work, see issue of The Engineering Record of Oct. 15.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Washington, D. C.—See "Sewerage and Sewage Disposal."

Jacksonville, Fla.—The following are the bids opened on Jan. 7, by the Superv. Archt. Treas. Dept., Washington, D. C., for the installation of an electric passenger elevator and hydraulic lift in the U. S. Post Office at Jacksonville: Otis Elevator Co., New York, N. Y., $7,285, and Marine Engine & Machine Co., of New York, $6,450.

Chicago, Ill.—Bids are wanted Feb. 7, for furnishing and delivering, f. o. b. cars, Chicago, steel wire nails, wrought iron and bolts, iron grilles, shelf hardware, galvanized steel roofing, etc. Address Lieut. Col. W. H. Miller, Ch. Q. M.

Rensselaer, Ind.—Bids are wanted Jan. 25 for constructing public ditch No. 2,918. J. N. Leatherman, Co. Aud.

Wabash, Ind.—It is reported bids will be received Jan. 29 by R. T. Adams, Co. Drainage Comr., for constructing the Geo. W. Smith ditch.

New Orleans, La.—Bids will be received by B. T. Clayton, Q. M., U. S. A., on Jan. 24 for constructing additional levees, repairing existing levees and filling in certain parts of reservation at Ft. St. Philip, La., as advertised in The Engineering Record.

*Engr. A. L. Phillips, 1561 St. Louis St., writes that Jas. Stewart & Co., of New York, N. Y., Pittsburg, Pa., and St. Louis, Mo., secured the contract on Dec. 28 for constructing the Chalmette terminals for the New Orleans Terminal Co. This work includes 72,185 cu. yd. concrete in wall, 500,000 cu. yd. dredging, 820,500 lin. ft. piling and 420,000 sq. ft. of warehouses; according to local press reports the contract price was about $2,500,000. The other bidders were: T. A. Kearns Co., of Chicago; Scott, White & Thompson, Hennen Bldg., New Orleans, and Oliver Sollitt Co., Chicago.

Bids will be received until Jan. 18, by the Bd. of Comrs. Orleans Levee Dist., (T. J. Duggan, Secy.) Rm. 15, Masonic Temple, for raising and enlarging the outer or canal side of the West End R. R. embankment in the 2d Dist. Length, 13,000 ft.; contents, 10,000 cu. yds.

St. Cloud, Minn.—The U. S. Senate is stated to have passed a bill permitting the building of a dam across Mississippi River at St. Cloud.

St. Louis, Mo.—F. W. Valliant, Sewer Comr., is stated to have prepared plans for straightening River des Peres, from Mississippi River up its course through the World's Fair grounds to the city limits on the west.

Helena, Mont.—John W. Wade, State Engr., writes in regard to the construction of a canal from Clark Fork River to the eastern part of the state, that the probable cost of the work is about $500,000. S. H. Glidden and E. S. Hall are interested.

**Princeton, N. J.*—The Hudson Eng. & Contr. Co., of New York, N. Y., is stated to have secured the contract for constructing the Carnegie Lake, for the Princeton University; the work will cost about $150,000.

**New York, N. Y.*—Geo. B. Spearin, 17 Battery Pl., New York, is stated to have secured the contract for building Dry Dock No. 4 at the Navy Yard (bids opened Dec. 31) at $757,000.

**New York, N. Y.*—The following are the bids opened on Dec. 5 by Maurice Featherson, Comr. of Docks, for 2,500 piles, yellow, pine or cypress (price given per pile): Simon H. Brown, 15 Broad St., $13.39; Stanley H. Miner, 11 Bway., $6.90 (awarded contract); Empire Timber Co., 256 Bway., $7.10; J. H. Burton, 18 Bway., $8.32; Nichols Bros., 74 Cortlandt St., $7.75; J. A. Rennolds & Bro., 85 West St., $8.10.

Bids will be received Jan. 20 by the Dept. Pub. Charities for furnishing material and repairing laundry machinery in laundry at city hospital, Blackwell's Island. Jas. H. Tully, Comr.

Bids will be received Jan. 24 by John McG. Woodbury, Comr. Street Cleaning, for furnishing and delivering iron.

Ft. Totten, Willet's Point, N. Y.—Bids will be received by Capt. Geo. H. McManus, Constructing Q. M., U. S. A., on Feb. 7 for the repair of portion of long wharf at this post, as advertised in The Engineering Record.

Columbus, O.—Local press reports state that preliminary steps are about to be taken by the State Bd. of Pub. Wks. (Chas. E. Perkins, Ch. Engr.) for the creation of a deep water link between Lake Erie and the Ohio River.

**Mansfield, O.*—France Bros., of Mansfield, are stated to have secured the contract for dredging 7 miles of Scioto River, to prevent floods on Hardin County Marsh, for $22,600.

Toledo, O.—The Comrs. of Lucas and Fulton Counties are stated to have decided to widen and deepen Ten Mile Creek ditch, at a cost of about $25,000.

Lakewood, O.—Bids are wanted Jan. 30, for $30,000 general improvement bonds. Henry J. Sensel, Village Clk.

Easton, Pa.—See "Paving and Roadmaking.

St. Clair, Pa.—Bids will be received until Feb. 1, for 200,000 yds. of stripping. Information may be obtained either at St. Clair, Pa., or Rm. 10, 96 Fifth Ave., New York, N. Y.

Philadelphia, Pa.—Bids are wanted Feb. 7 for furnishing nails, wrought-iron and bolts, iron grilles, hardware, galvanized steel roofing, etc. Lieut.-Col. J. W. Pope, D. Q. M. G., U. S. A.

The plans of Andrew J. Sauer, of Philadelphia, are stated to have been accepted for a park and recreation pier to be erected on the Delaware River in the southeastern part of city, at Oregon, Johnston, Bigler, Spangler and East Sts. It will be 800 ft. long, and have an outside promenade 50 ft. wide.

**Petersburg, Va.*—The Atlantic Dredging Co., of Philadelphia, Pa., is stated to have secured the contract for dredging the channel of Appomattox River from city limits to Sunken Island, at 37 cts. per cu. ft., or a total of $10,000.

Tacoma, Wash.—Local press reports state that bids will be received until Jan. 20, by the Co. Comrs., for constructing a wharf at Balch's Cove.

**Peterboro, Ont.*—The contract for constructing the new lift lock in Trent Canal is reported to have been awarded to the Dominion Bridge Co., of Montreal, Que. The towers will be of steel and must support a lift of 50 ft. The work must be finished by the spring of 1906.

PROPOSALS OPEN.

For proposals see pages 24 and 27.

WATER WORKS.

Bids Close.		See Eng. Record.
Jan 19.	San Diego, Cal.	Jan. 7
Jan. 20.	Water gates, pipes, etc., St. Paul, Minn.	Jan. 14
Jan. 21.	Pipe, Lindsborg, Kan.	Jan. 14
Jan. 21.	Main, Lakewood, O.	Jan. 14
Jan. 21.	Newark, O	Jan. 7
Feb. 23.	Tilamook, Ore.	Jan. 14
Jan. 23.	Louisburg, N. C., Adv. Jan. 7.	Jan. 7
Jan. 24.	Well, Dallas, Tex.	Jan. 7
Jan. 25.	Oxford, N. C., Adv. Jan. 14.	Jan. 14
Jan. 25.	Supplies, New York, N. Y.	Jan. 14
Jan. 25.	Castings, Brooklyn, N. Y.	Jan. 14
Jan. 25.	Deadwood, S. D. Adv. Nov. 26 to Jan. 14.	Dec. 17
Jan. 28.	Boiler and tank, Ft. Logan. Logan, Colo.	Jan. 14
Jan. 28.	Phoenix, Ariz	Jan. 7
Feb. 1.	Hydrants, etc., Brooklyn, N.Y.	Jan. 14
Feb. 1.	**Princeton, Ky.**	**Dec. 10**
Feb. 1.	Pipe, San Francisco, Cal.	Dec. 3
Feb. 6.	Pump, etc., Jacksonville, Fla.	Jan. 14
Feb. 7.	Chrisman, Ill.	Jan. 14
Feb. 8.	Pipe, South Bend, Ind.	Jan. 14
Feb. 10.	Bishop, Cal. Adv. Dec. 10 to 24.	Dec. 10
Mar. 31.	Meters, Pocatello, Idaho	Jan. 14
Mar. —.	Smith's Grove, Ky	Jan. 7
Apr. 1.	Irrig., Usk, Wash	Dec. 24
———	Pipe, Auburn, Me.	Jan. 14

SEWERAGE AND SEWAGE DISPOSAL.

Jan. 16.	Jersey City, N. J.	Jan. 14
Jan. 17.	Jewett City, Conn.	Jan. 7
Jan. 18.	Brooklyn, N. Y.	Jan. 7
Jan. 19.	Toledo, O.	Jan. 14
Jan. 19.	Washington, D. C. Adv. Jan. 14.	Jan. 14
Jan. 19.	San Diego, Cal.	Jan. 7
Jan. 20.	Dayton, O.	Jan. 14
Jan. 23.	Louisburg, N.C., Adv. Jan. 7.	Jan. 7
Jan. 26.	Coldwater, Mich.	Jan. 7
Jan. 30.	Washington, D. C. Adv. Jan. 14.	Jan. 14
Feb. 1.	Palatka, Fla., Adv. Jan. 14.	Jan. 14
Feb. 1.	Cresco, Ia.	Dec. 31
Feb. 4.	Fort. Michie, N. Y.	Jan. 14
Feb. 6.	Washington, D. C. Adv. Jan. 14.	Jan. 14
Feb. 6.	Topeka, Kan.	Jan. 14
Feb. 7.	Los Angeles, Cal.	Jan. 7
Feb. 10.	Bishop, Cal. Adv. Dec. 10 to 24.	Dec. 10
Feb. 15.	Linenburg, N. S.	Jan. 14

BRIDGES.

Jan. 19.	Toledo, O.	Dec. 31
Feb. 6.	Topeka, Kan.	Jan. 14
Feb. 6.	Santa Barbara, Cal.	Jan. 7
Feb. 7.	Muscatine, Ia.	Jan. 14
Feb. 7.	Wabash, Ind.	Jan. 14
Feb. 14.	Napa, Cal.	Dec. 31

PAVING AND ROADMAKING.

Jan. 16.	Detroit, Mich.	Jan. 14
Jan. 16.	Atlantic City, N. J. (4 Prop.), Adv. Dec. 31.	Dec. 31
Jan. 17.	New York, N. Y.	Jan. 7
Jan. 17.	Collingswood, N. J.	Jan. 7
Jan. 18.	Harrisburg, Pa.	Jan. 14
Jan. 18.	Cincinnati, O.	Dec. 31
Jan. 19.	Chicago, Ill.	Jan. 14
Jan. 19.	Cincinnati, O.	Jan. 14
Jan. 19.	Ingram, Pa.	Jan. 14
Jan. 21.	Sussex, N.J., Adv. Jan. 7, 14.	Jan. 7
Jan. 21.	Emeryville, Cal.	Jan. 7
Jan. 25.	Cleveland, O.	Jan. 14
Jan. 26.	Cortland, N.Y., Adv. Jan. 14.	Jan. 14
Jan. 27.	St. Louis, Mo.	Jan. 14
Jan. 31.	Ebensburg, Pa.	Jan. 7
Feb. 1.	Cincinnati, O.	Jan. 14
Feb. 2.	Cincinnati, O.	Jan. 14
Feb. 6.	Topeka, Kan.	Jan. 14
Feb. 6.	Webb City, Mo., Adv. Jan. 7.	Jan. 7
Feb. 7.	Rensselaer, Ind.	Dec. 31
Feb. 14.	Napa, Cal.	Dec. 31

POWER, GAS AND ELECTRICITY.

Jan. 16.	Governor's Island, N. Y.	Jan. 7
Jan. 17.	Spring Lake, N. J.	Jan. 14
Jan. 17.	Washington, D. C.	Jan. 7
Jan. 17.	Chicago, Ill.	Dec. 24
Jan. 18.	Coffeyville, Kan.	Jan. 14
Jan. 18.	Little Rock, Ark.	Jan. 14
Jan. 21.	Washington, D. C.	Jan. 7
Jan. 21.	Ft. Snelling, Minn.	Dec. 31
Jan. 23.	Indianapolis, Ind.	Jan. 14
Jan. 24.	Washington, D. C.	Jan. 14
Jan. 24.	Riverside, Cal.	Jan. 7
Jan. 24.	Newport, R. I.	Dec. 31
Jan. 25.	Oxford, N. C., Adv. Jan. 14.	Jan. 14
Jan. 28.	Ft. D. A. Russell, Wyo. Adv. Dec. 31 to Jan. 14.	Dec. 31
Jan. 31.	Ft. Walla Walla, Wash.	Jan. 7
Feb. 2.	Lakewood, O.	Jan. 14
Feb. 2.	Columbus, Ind.	Jan. 14
Feb. 15.	Chicago, Ill.	Dec. 24

BUILDINGS.

Jan. 14.	Plumbing, Pub. Bldg., Ft. Sam Houston, Tex.	Jan. 14
Jan. 16.	Schools, Brooklyn, N. Y.	Jan. 7
Jan. 16.	School, New York, N. Y.	Jan. 7
Jan. 16.	School, Long Island City, L.I., N. Y.	Jan. 7
Jan. 16.	School, New Brighton, S. I., N. Y.	Jan. 7
Jan. 16.	School, Lewiston, N. Y.	Jan. 7
Jan. 16.	Hospital, Ft. Screven, Ga. Adv. Dec. 24 to Jan. 14.	Dec. 24
Jan. 17.	Engine House, New Haven, Conn.	Jan. 7
Jan. 18.	Court House, Camden, S. C.	Jan. 7
Jan. 18.	Guard House, Ft. Thomas, Ky.	Dec. 31
Jan. 18.	Htg. P. O. Bldg., Yankton, S. D.	Dec. 24
Jan. 19.	Pub. Bldgs., Ft. Meade, S.D.	Jan. 7
Jan. 19.	Post Bldgs. Ft., Des Moines, Ia., Dec. 24 to Jan. 14.	Dec. 24
Jan. 19.	P. O. Bldg., Fresno, Cal. Adv. Dec. 3, 10.	Dec. 3
Jan. 20.	Pub. Bldg., Ft. Logan H. Roots, Ark.	Dec. 24
Jan. 20.	Post Bldg., Governor's Island, N. Y.	Dec. 24
Jan. 21.	Hospital, Sandusky, O.	Jan. 14
Jan. 23.	School, New York, N. Y.	Jan. 14
Jan. 23.	School, Brooklyn, N. Y.	Jan. 14
Jan. 23.	Church, Waupaca, Wis.	Jan. 7
Jan. 23.	School, Cincinnati, O.	Jan. 7
Jan. 24.	School, Galena, Ill.	Jan. 7
Jan. 25.	Post Bldg., Ft. Wayne, Detroit. Mich., Adv. Jan. 14.	Jan. 14
Jan. 25.	**P. O. Bldg., Washington, Pa. Adv. Dec. 3, 10.**	**Dec. 3**
Jan. 26.	School, Ames, Ia.	Jan. 14
Jan. 26.	School, Ft. Mojave, Ariz.	Jan. 7
Jan. 26.	Moving Univ. Bldg., Iowa City, Ia., Adv. Jan. 7 and 14.	Jan. 7
Jan. 27.	Storage Bldg., Jeffersonville, Ind.	Jan. 14
Jan. 27.	Htg. Pub. Bldg., Los Angeles, Cal.	Jan. 14
Jan. 28.	Police Station, Newburg Heights, O.	Dec. 31
Jan. 30.	Pub. Bldgs., Ft. Crook, Neb.	Jan. 14
Jan. 30.	School, Webster, N. D.	Jan. 7
Jan. 30.	P. O. Bldg., Dekalb, Ill	Jan. 7
Jan. 31.	Flat, Bayonne, N. J.	Jan. 14
Jan. 31.	Pub. Bldg., Ft. Moultrie, S. C.	Jan. 7
Jan. 31.	**P. O. Bldg., Albert Lea, Minn.**	**Dec. 10**
Jan. —.	**Public Bldg., Des Moines, Ia.**	**Dec. 3**
Feb. 1.	Church, Montezuma, O.	Jan. 14
Feb. 1.	Arsenal and armory, Hartford, Conn.	Jan. 14
Feb. 1.	P. O. Bldg., Ogden, Utah Adv. Dec. 31.	Dec. 31
Feb. 1.	Church, Zanesville, O.	Dec. 31
Feb. 1.	Court House, Goshen, Ind.	Dec. 31
Feb. 1.	Court House. Elkhart, Ind.	Dec. 3
Feb. 2.	Htg. P.O. Bldg., Atlantic City, N. J., Adv. Jan. 14.	Jan. 14
Feb. 4.	School, Canandaigua, N. Y.	Jan. 14
Feb. 6.	Court House, Ocala, Fla.	Jan. 14
Feb. 6.	Htg. Post Bldg., Ft. Mott, N. J., Adv. Jan. 14.	Jan. 14
Feb. 7.	School. Lac du Flambeau, Wis.	Jan. 14
Feb. 7.	P. O. Bldg., Nevada, Mo.	Dec. 31
Feb. 8.	School, Bolivar, N. Y.	Jan. 14
Feb. 8.	School, Halstad, Minn.	Jan. 14
Feb. 9.	Post Bldg., Plattsburg Barracks, N. Y., Adv. Jan. 14.	Jan. 14
Feb. 9.	Post Bldg., Tompkinsville, S. I., N. Y., Adv. Jan. 14.	Jan. 14
Feb. 9.	P. O. Bldg., Natchez, Miss. Adv. Jan. 7 and 14.	Jan. 7
Feb. 14.	Htg. P. O. Bldg., Batesville, Ark., Adv. Jun. 14.	Jan. 14
Feb. 15.	Htg. P. O., Chillicothe, O.	Jan. 14
Feb. 21.	P. O. Bldg., Westchester, Pa. Adv. Dec. 31 to Jan. 7.	Dec. 31
Feb. 23.	P. O. Bldg., Decatur, Ill. Adv. Jan. 14.	Jan. 14
Feb. —.	Hospital, Albany, N. Y.	Dec. 24
Mar. 6.	Court House, Sardis, Miss.	Dec. 17
Apr. 5.	**Court House plans, New Orleans, La.**	**Dec. 3**

MISCELLANEOUS.

Jan. 17.	**Supplies, Washington, D. C.**	**Dec. 31**
Jan. 18.	Levee work, New Orleans, La.	Jan. 14
Jan. 18.	R. R. work, Columbus, O.	Jan. 14
Jan. 18.	Plumbing material, etc., Panama	Dec. 24
Jan. 19.	El. Ry. work, Brooklyn, N.Y.	Jan. 7
Jan. 19.	Fuel Oil Plant, Springfield, Mass.	Jan. 7
Jan. 20.	Machinery, New York, N. Y.	Jan. 14
Jan. 20.	Wharf, Tacoma, Wash	Jan. 14
Jan. 20.	R. R. work, Guthrie, Okla. Ter.	Dec. 17
Jan. 23.	Dredging, New Orleans, La.	Dec. 3
Jan. 24.	Levee work, New Orleans, La. Adv. Jan. 7.	Jan. 14
Jan. 24.	Iron, New York, N. Y.	Jan. 14
Jan. 24.	Piles, Panama	Dec. 31
Jan. 25.	Ditch, Rensselaer, Ind.	Jan. 14
Jan. 26.	Breakwater, Toronto, Ont.	Jan. 7
Jan. 28.	Draft plant, West Point, N. Y., Adv. Jan. 7 and 14.	Jan. 7
Jan. 29.	Ditch, Wabash, Ind.	Jan. 14
Jan. 31.	Jetty, Portland, Ore.	Jan. 7
Feb. 1.	Stripping, St. Calir, Pa. Adv. Jan. 14.	Jan. 14
Feb. 1.	R. R. work, Sonoma, Cal.	Dec. 24
Feb. 3.	Piles, San Francisco, Cal. Adv. Jan. 14.	Jan. 14
Feb. 3.	Dredging, Savannah, Ga. Adv. Jan. 7 and 14.	Jan. 7
Feb. 4.	Industrial Plant, Philadelphia, Pa.	Jan. 7
Feb. 4.	Dredging, Chicago, Ill. Adv. Jan. 7 and 14.	Jan. 7
Feb. 7.	Supplies, Philadelphia, Pa.	Jan. 14
Feb. 7.	Wharf, Ft. Totten, Willets Point, N. Y., Adv. Jan. 14.	Jan. 14
Feb. 7.	Bldg. supplies, Chicago, Ill.	Jan. 14
Feb. 8.	**Dam, etc., Phoenix, Ariz. Adv. Dec. 3 to 24.**	**Dec. 3**
Mar. 15.	Dam, etc., Los Angeles, Cal. Adv. Jan. 14.	Jan. 14
Feb. 15.	Dredging, Chicago, Ill.	Dec. 24
Mar. 31.	**El. Ry., Shanghai, China**	**Oct, 22**

**Items marked thus give the names of parties awarded contracts.*